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Heating Piping & Air Conditioning

DESIGN
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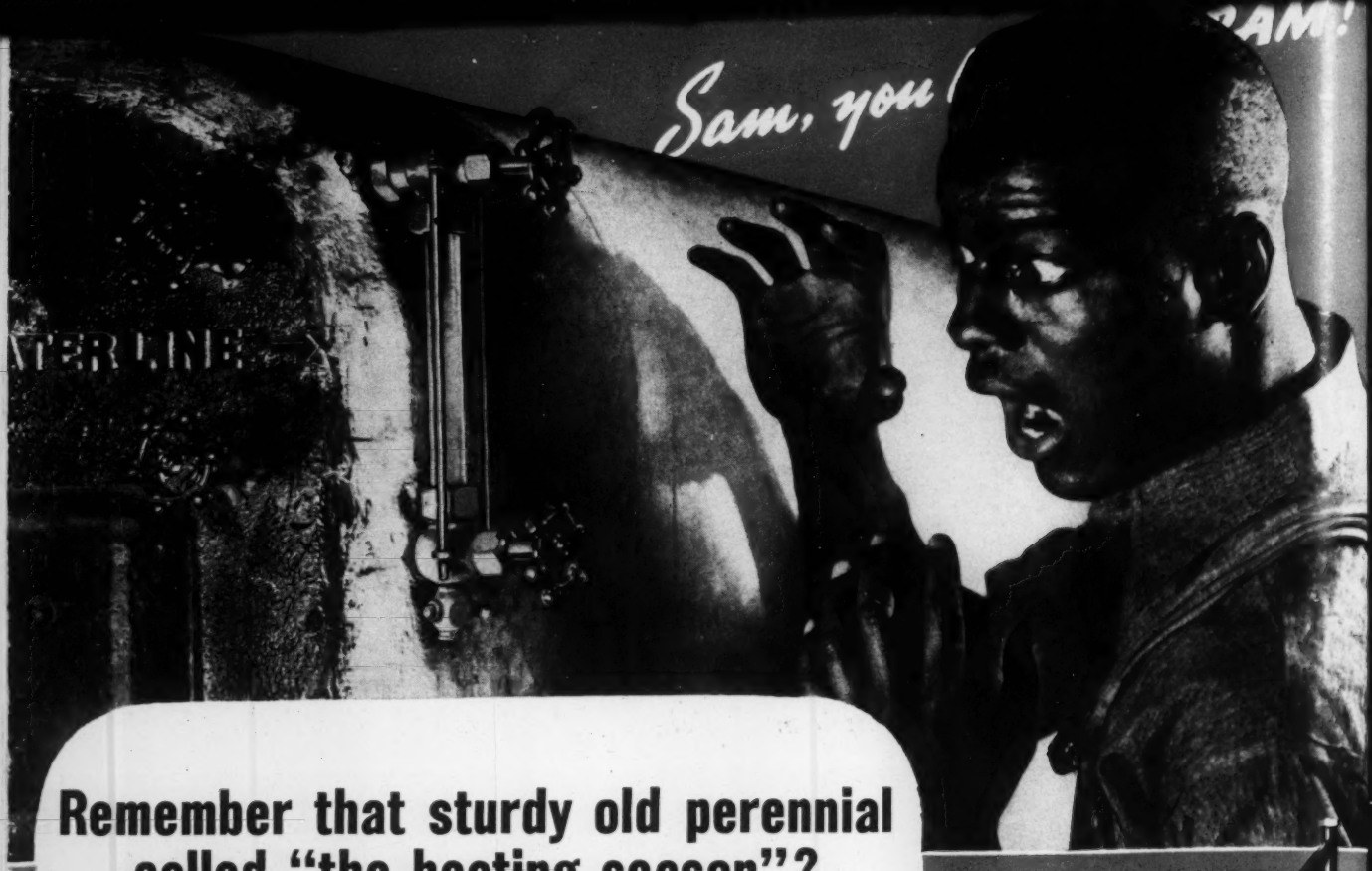
AUGUST ★ 1946

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

101 — *Journal Section of the American Society of Heating and Ventilating Engineers*

CONTENTS . . PAGE 69

See page 71 for valuable information on how to analyze air conditioning systems for multi-room buildings



Remember that sturdy old perennial called "the heating season"?

WAR years have no seasons or schedules; just over-taxed plants and over-taxed people messed up in shortages and back-logs and disgruntled customers—problems that keep right on defying solution long after the firing stops. No wonder old friends like the heating season are lost in the shuffle. Why just think of it: This is the time of year when every heating man was busily cultivating that hearty old perennial, and now no one seems to care much whether it blooms or dies on the vine!

Of one thing, though, you can be dead sure: Old Man Winter hasn't forgotten! The season is the fundamental thing, and all the rest—the this-and-that problems and situations—are simply the incidentals. Cold weather will strike as usual and fires will burn under a lot of steam boilers, and many a war-forlorn heating plant will need plenty of fixing up to keep it out of trouble—among other troubles, low water.

Yes, this is a good time to get back to fundamentals—a good time to say "This is where we came in"—a good time to sell, among other things, the idea of protecting every steam boiler from low water damage with McDonnell Boiler Water Feeders and Low Water Cut-Offs.

Here at the plant we decided some time ago to get back to fundamentals, and while we haven't been able to lick all the incidentals completely, we *have* gained a lot of ground. Better methods, higher efficiency, greatly enlarged facilities are taking us ever closer to the day when we can again burn our back-log daily and ship every solitary order the mail man brings us. Your customers need the Sam-you-better-scram idea this heating season!

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Doing One Thing Well

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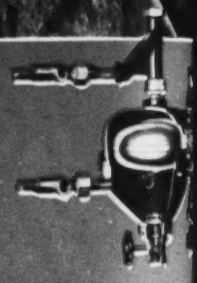
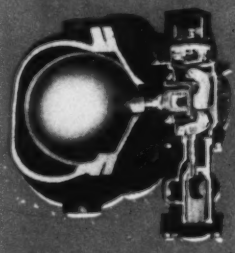
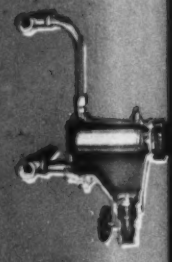


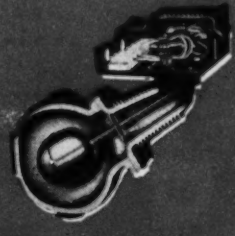
No. 47-2 Feeder-Cut-off Combination for boilers below 5000 sq. ft.; maximum steam pressure, 25 lbs. Quick-Hook-Up for speedy, correct installation.



No. 51-2 Feeder-Cut-off Combination for [illegible] tions same as 47-2, for boilers larger than 5000 sq. ft.; maximum steam pressure, 35 lbs.



No. 67 Low Water Cut-off for all automatically fired boilers; maximum steam pressure, 25 lbs.



No. 150 Water Level Control for boilers of [illegible] size with steam pressures up to 150 lbs. Used as feed-pump control; low water cut-off low water alarm, or any combination of these functions.

McDONNELL

Boiler Water Level Controls

HEAT PUMP GETTING WIDESPREAD ATTENTION

The reverse refrigeration cycle, or heat pump, for year 'round air conditioning—heating in winter and cooling in summer—is getting quite a bit of attention these days from utility men in particular, who see in its increased application attractive possibilities for electrical load 12 months of the year. Essentially—of course—a heat pump is an ordinary refrigeration cycle, arranged in cold weather to pump heat into a building rather than out of it, the source of heat being the outside air; water in a well, lake, or pond; or the ground. By this means, 1 kwhr of electricity expended for pumping results in three or four, or more, its equivalent in heat delivered to the building.

In addition to studies on equipment development and control arrangements for utilizing the cycle by the most feasible means, research is under way at several places to determine the coefficients of performance that can be obtained in actual service, and the best sources of outside heat. Answers to such questions as the amount of heat that can be obtained from coils buried in the ground at various depths, or the amount of heat that can be gotten from a well, are being sought.

A bibliography on the heat pump as a device for domestic and industrial winter heating and summer cooling has been issued by the Southern Research Institute, Birmingham 5, Ala. The publication represents completion of one phase of a comprehensive research project sponsored by the Southeastern Electric Exchange, an association of electric utility companies operating in the southern states. Copies are available for distribution to libraries and others interested in this subject.

Current interest in the heat pump is by no means confined to the U.S.A. The June issue of the British publication, The Heating and Ventilating Engineer & Journal of Air Conditioning, carried a 16 page paper by D. V. Onslow which comprises a critical resume of published information and has a bibliography of 89 references (many of them to articles and papers in HPAC).

In his conclusions, Mr. Onslow points out that the heat pump insures a saving of high grade energy equivalent to several times the amount expended, but that the full economic benefit of the system is not obtained unless summer air conditioning is also employed. Efficiency is greatly affected by the temperature of the heat source, he stresses. He says also that the interval through which the heat energy is pumped must be as small as possible, and the amount of energy to be dealt with as large as possible, to enable a plant to be economical. The substantial rise in the cost of coal in England during the war merits re-examination of the heat pump system, he states.

WYATT ISSUES REPORT ON HOUSING PROGRESS

A total of 225,000 houses and apartments were completed and nearly half a million started under the veterans emergency housing program in the first six months of the year, Wilson W. Wyatt, housing expediter and administrator of the National Housing Agency, announced earlier this month in a progress report to the nation.

Of the units completed this year, Mr. Wyatt said, 153,000 are new permanent houses and apartments, and 72,000 are temporary re-use housing, conversions, and trailers. Nearly all of the latter were started this year. Of the new permanent units, 113,000 are houses and apartments started in 1945 on which progress had virtually stopped because of materials shortages by the end of the year. Nearly all the 1945 residential units have been completed, he said.

The remaining 40,000 new permanent completions were started in 1946, largely in the first two or three months of the year. They are equal to more than half of the starts in the first two months of the year, and 30 per cent of all starts prior to April 1.

SEES 30 PER CENT GREATER GENERATING CAPACITY

America's electric power industry, expanding at an unprecedented rate, will probably have a 30 per cent greater generating capacity for industrial and home use by

THE EDITOR'S PAGES

1950, according to Gwilym A. Price, president of the Westinghouse Electric Corp., who estimated that his company's sales of central station equipment will represent 27 per cent of its total business in 1946. In 1944, equipment of this nature represented less than 2 per cent of the company's record production.

Indicative of the large scale and forward-looking programs of the utilities, Mr. Price pointed out, is the fact that more than 55 large utilities have placed orders in excess of half a million dollars each. Some of these orders have been placed for delivery in 1949. "Since this condition is general throughout the heavy electrical equipment industry," Mr. Price said, "it appears that the central station equipment manufacturers of the nation will be at peak production at least until well into 1949."

COAL PRODUCERS SMOKE COMMITTEE MEETS

The Coal Producers Committee for Smoke Abatement held its semi-annual meeting at Cincinnati last month, to review the work performed during the first half of 1946 and to lay plans for the remainder of the year. Chairman R. E. Howe announced that surveys had been completed in Toledo, Akron, Youngstown and Cleveland, Ohio, and Durham, N. C., since January, when the committee was reactivated after having been dormant during the war. It was agreed that the survey work should continue in cities and municipalities sincerely interested in the abatement of smoke, as the survey "is the only known method of determining the origin and cause of smoke."

It was reported at the meeting that the present membership of the committee is comprised of 12 coal producing districts and five coal hauling railroads.

THE EDITOR'S PAGES

DON'T BE TOO "PRACTICAL"

Many a man long on "book learning" and with a good theoretical background but short on direct practical experience in installation, operation, or maintenance of equipment, gets into trouble—and there are lots of stories about the funny things they've done when faced with a practical problem that demands quick action.

It works both ways, though, and there's also such a thing as being too "practical." A friend of ours with a lot of design experience in marine engineering recently went to sea for some operating knowledge. One fellow he ran across—first engineer on a tanker—was so "practical" that he let water hammer break the same valve three different times because he wouldn't open the proper drain connections. "Too theoretical, that stuff," was his opinion.

Like everything else, it's a matter of the proper balance between theory and practical knowledge. The danger lies in trying to make up for your own deficiencies by talking down the importance of what you don't know.

MAKING MEETINGS LIVELIER

Almost every speaker at an engineering meeting probably worries about the interest of the audience in his talk (we say "almost," because we're sure that some we've listened to never gave the matter a thought or they wouldn't have gone on and on the way they did). One of the best indications of audience-interest in a talk is the number of questions asked the speaker, and the audience comment the talk arouses.

It's a good idea to get the "open for discussion" ball rolling by planting a few advance questions with selected members of the audience. Good, logical questions can be worked out by the speaker or the committee in charge ahead of the meeting and handed out for use at the discussion period. Two or three such questions lead to others, and what otherwise may be a flat affair is often turned into a lively session.

It seems to us that a good question-and-answer period, with both the speaker and various members of the audience answering the questions and making comments, is a lot more interesting and valuable than prepared and formal "discussions" of papers—especially when the discussions are read (as they so often are), not by the men who wrote them but by a "reading clerk" who is handed the material two minutes before he gets up on the platform.

"PET PEEVE" DEPARTMENT

A few issues ago we were rash enough to suggest on these pages that perhaps we ought to start a "pet peeve" department, and we invited anyone who wanted to to let us know about some of the things they'd like to see changed. We've gotten some good ideas—mostly pertaining to the magazine—and will cheerfully follow all advice received insofar as possible.

A couple of HPAC's readers have objected to our present method of numbering our pages; each month we start over again, the front cover being considered as page 1. Formerly, we numbered the editorial section consecutively throughout the year, the first editorial page in January being page 1 and the last one in December being page 664, or something like that.

One reader says that with the present system he's going to have the devil's own time in finding anything in "our valuable magazine" (we quote) when he binds the year's issues into book form. We've written him as follows, but we'd like any commment that may be forthcoming from other readers on this matter:

"This change was made only after careful consideration of the advantages and disadvantages. We realized that it would be not as convenient as our old method for those of our readers who bind the editorial section only in a book each year. It was our feeling, however, that the majority of our readers either bind the entire issue—that is, both advertising and editorial pages—or preserve the individual issues without binding them into yearly volumes.

"As to locating material in bound volumes with the present system of folioing, our index will show, as it has in the past, the month of issue as well as the page number, and we are sure you will not find this too inconvenient; at least, we hope you won't."

GUY B. PANERO SUCCEEDS CLYDE R. PLACE

Guy B. Panero, internationally-known engineer recently cited by the War Department for a special mission investigating new chemical processes in Germany, has purchased the consulting engineering firm of the late Clyde R. Place, and is now directing the organization.

Mr. Panero has been engaged in engineering and building activities since 1925 both here and abroad. Before going to Germany, where he remained for five months, he was chief engineer in charge of the entire programs for several large industrial facilities, among them the 42-million dollar Wolf Creek ordnance plant at Milan, Tenn., and the 20-million dollar Gulf ordnance plant at Aberdeen, Miss. He was construction manager for synthetic rubber plants at Baton Rouge and Lake Charles, La.

In addition to his experience in the industrial field, Mr. Panero has also worked extensively in institutional and commercial building. He served in an engineering capacity with the constructors of the Rockefeller Center development and his work in Europe includes the American Embassy and Maison Internationale in Paris; Earl's Court in London, and industrial and residential projects in Brussels and Milan.

The organization which Mr. Panero has taken over has been one of the most active engineering firms in the New York area.

* * * * *

Equipment Developments and Recent Trade Literature are reviewed each month in HPAC. Don't miss these regular departments!

Heating Piping & Air Conditioning

with which is merged the Aerologist

Design, Installation,
Operation, and Maintenance:
Industrial, Commercial, Institutional,
and Public Buildings

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Advertising Staff

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Telephone: Murray Hill 9-8293

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Publisher
Frank P. Keeney

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CONTENTS THIS MONTH

Vol. 18 **AUGUST 1946** No. 8

The Editor's Pages (news notes and comment) 65

How to Analyze Air Conditioning Systems for Multi-Room Buildings, by George W. Meek 71

Flow Failure Control in Piping Circuits, by Melvin A. Ramsey 78

"Open for Discussion" 82

Air Conditioning Requirements for Workers in Factories, by H. A. Mosher 82

What's Wrong (If Anything) With the Construction Industry?, by Lester T. Avery 83

Using the Reverse Cycle for Heating, Conditioning, by G. E. Clancy 84

Proper Condensate Elimination Is Vital to Unit Heater Performance, by Robert V. Williams 86

Question of the Month—Use Tank or Tankless Type of Water Heater? 87

Simple Attachment for Cutting Pipe 88

Selecting Roof Ventilators, by C. R. Gelert 89

Comparative Engineering Data on Refrigerants Given in New Tables 91

Sam Lewis' Page—Practical Pointers on Kitchen Ventilation 94

Pipe Line for Liquid Carbon Dioxide Eliminates Handling, Shipping, Problems 96

Duct Sizing With Partial Static Regain, by R. H. Anderegg and F. W. Hutchinson 97

Data Sheet—Duct Sizing 99

Equipment Developments 155

New Books & Reports 174

Meetings & Conventions 181

Recent Trade Literature 184

Index to Advertisers 198

Journal Section of the American Society of Heating and Ventilating Engineers

Hold-Fire Controls for Bituminous Coal Stokers, by C. C. Wright, T. S. Spicer, and H. A. Baumann 101

Chemical Removal of Scales, Sludges, and Oxides, by Guy F. Williams 108

The Research Reporter 112

Semi-Annual Meeting in Canada 114

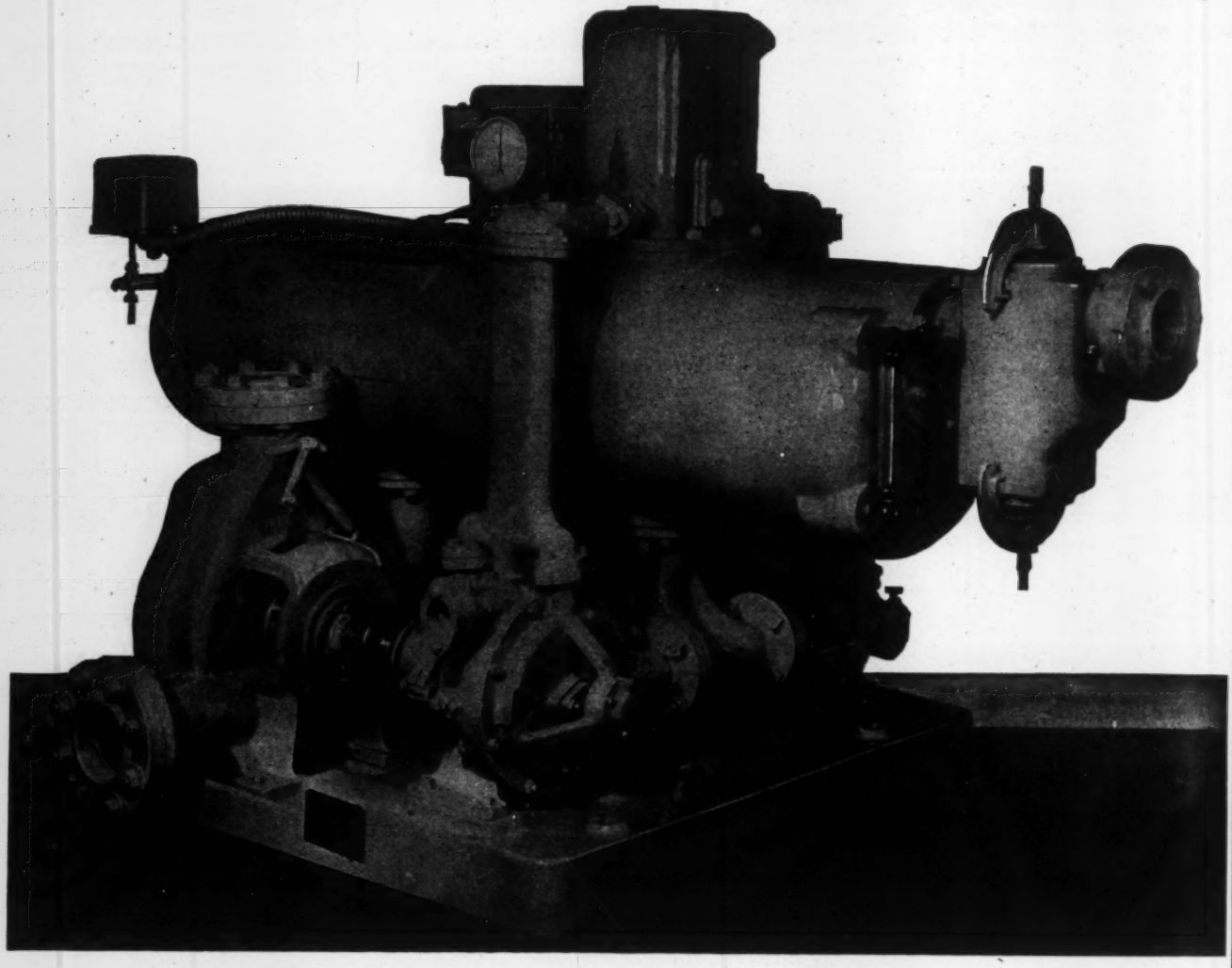
Summary of Local Chapter Meetings 124

Candidates for Membership 125

Candidates Elected 126

Officers, Council, and Committees 128

Where Heat Must Not Fail— Install this SAFE Heating Pump!



In Hospitals, Greenhouses, Schools, Public Buildings, Theatres, wherever heating systems must not fail, install the Nash Vapor Turbine, for it is entirely independent of electric current failure, and continues to operate as long as there is steam in the system.

More than that, the Vapor Turbine is a most economical pump, for the elimination of electric current does away with current cost, the largest single item in the operation of an ordinary return line heating pump.

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THE NASH ENGINEERING COMPANY

SOUTH NORWALK, CONNECTICUT, U. S. A.

AIR CONDITIONING SYSTEMS for MULTI-ROOM BUILDINGS

By George W. Meek
Consulting Engineer

IN TRYING to tell what makes for quality in a multi-room air conditioning installation, the problem is the same as to *objectives* as it is for most other types of air conditioning installations—namely, the control of temperature, humidity, air motion, cleanliness, and odor level to such an extent *that the user is unaware of these factors.*

However, the problem differs considerably as to *method* of accomplishment. When the application engineer is faced with the selection of equipment for a dress shop, theater, or auditorium, the possible equipment combinations are not many. But when designing the air conditioning installation of, say, a building of 10 or more floors, the engineer is faced with the need for giving due consideration to at least 12 entirely different equipment arrangements.

Importance of Application Engineering

The reputation of the engineering profession is influenced to a great degree by how successfully the *application* engineer utilizes available equipment to produce "an absence of discomfort" than it is by, say, five or 10 years of strenuous effort to increase a fin coil heat transfer rate—even if such an effort is crowned by the spectacular success of a 100 per cent increase. In the case of a multi-room building (apartment house, hospital, office building, hotel) the sheer size of the capital expenditure (a few dozen installations may equal the dollar value of an entire year's production of portable and self-contained air conditioners) makes it even more important that engineers and architects be familiar first with all of the more important equipment combinations and, second, know intimately the strong and weak points of each.

Seldom will it be found that there is only *one* equipment combination which will produce a quality installation in a multi-room building. Usually two or more approaches—and sometimes quite different approaches, at that—are theoretically capable of resulting in a satisfactory installation, but the results in each case may depend largely on an intangible something that might be called the architect's or the engineer's "professional proficiency." No mysticism is intended, but the fact remains that—due either to previous experience, education, or sheer difference in engineering ability—two engineers may each choose a given equipment combination and get different results. The author cannot hope to point out methods of overcoming such a situation, but examination of published literature shows that there is room for a simplified summary of the many apparatus combinations which must be considered for multi-room buildings, and room for an attempt at a still further analysis of the strong and weak points of each.

Data Presented in Tabular Form

The data on each system are presented in tabular form primarily for the sake of comparison, even though this arrangement has the disadvantage of limiting the comments on those little details which are sometimes the difference between an outstanding or a mediocre installation.

In regard to the ratings under Item 5 (Relative Considerations) of the tables, it is obvious that at best the comparative ratings (*A* for best, *B*, *C*, etc.) are only general guides. Actually, the author

THE PROBLEM of satisfying the user is more difficult, the author believes, in a multi-room air conditioning installation than it is with most other types of comfort air conditioning. The complications are so numerous and the monetary value of the equipment is so great that a detailed assignment should be undertaken only after careful study of the problem. . . . Mr. Meek's principal objective here is to present analysis charts of the several types of installations for multi-room buildings to simplify the study which is necessary, and he supplements the charts with some very practical suggestions in the text. Mr. Meek discussed this subject at a session at the ASRE'S spring meeting.

"When designing the air conditioning installation for a building of 10 or more floors, the engineer is faced with the need for giving due consideration to at least 12 different arrangements."

reluctantly includes Item 5c, which is an all-round evaluation of performance.

There seems to be a very definite need for an evaluation of the overall performance of the many systems described on the charts, but the reader must realize that the ratings are extremely relative, and due to individual job considerations, may vary through ratings of *A* to almost *D*, even with one given type of equipment.

In some instances, the importance of one or two considerations may dictate the choice, even though that choice carries a very low rating on other considerations. For example, a hospital arrangement may place such importance on Items 5g, 5j, and 5k as to dictate the selection of a system which has something less than an overall *A* or *AA* rating.

(Central apparatus layouts for systems which require centralized cooling, heating, humidification, dehumidification, and air purification, are given in considerable detail in chapter 43 of the 1946 issue of the ASHVE's Heating, Ventilating, Air Conditioning Guide, in Section 60 of the 1946 issue of the ASRE Data Book, and in the book, Modern Air Conditioning, Heating and Ventilating, by Carrier, Cherne, and Grant).

Design Considerations

An engineer, an architect, or an installing contractor may have had years of experience in the design of systems for dress shops, department stores, theaters, individual offices, and all types of industrial applications, and still not be aware of several important aspects of the problem of applying air conditioning to large multi-room buildings.

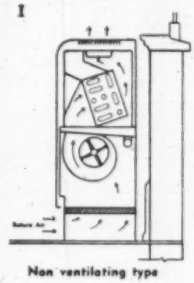
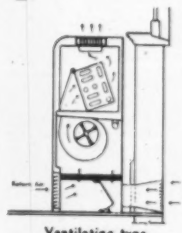
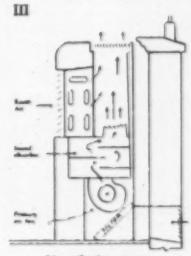
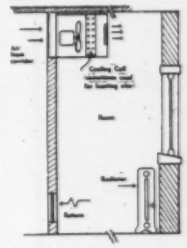
Some of these aspects have their basis in what might be called the "psychology" of the occupant, but some are a direct outgrowth of special conditions which are not encountered on the types of air conditioning installations mentioned above.

A.) *Performance Expectations*—The man who purchases a portable room cooler for his office, for instance, or (in fact) even the man who purchases air conditioning equipment for his dress shop, does not expect as much from his equipment as does the office worker or hotel guest. For one thing, in the case of the individual who purchased the room cooler or the storekeeper who purchased the air conditioning system, it is his own purchase, and obviously he spent a lot of time deciding on which was the "best" equipment to buy. Silly as it may seem, he will put up with a lot more in the way of unsatisfactory performance than will a hotel guest who reasons, "This blankety-blank hotel has been advertising its marvelous air conditioning system, and yet now I want to retire and though I have twisted this knob as much as I can, I still can't reduce this room temperature to the level to which I am accustomed for sleeping."

This same type of thing, of course, applies to the occupants of large office buildings, large apartment houses, or hospitals, and—whether we like it or not—this situation results in the establishment of higher performance expectations for this type of air conditioning than for almost any other type of installation.

B.) *Type and Extent of Controls*—In a situation where a building has an occasional office equipped with room coolers, it is generally found that some one person more or less accepts the responsibility of turning the switches on and off, and adjusting the knobs to maintain a satisfactory temperature level throughout the day. When, however, air conditioning is installed throughout a large office building, it is no longer possible to rely upon the occupants for doing any appreciable manipulating of controls. Even in the case of a large building heated with radiators, the occupants will, for some strange reason, open a window

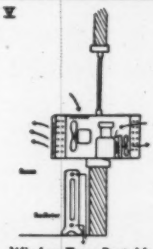
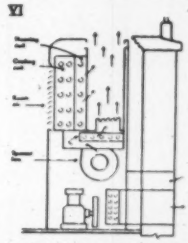
Comparison of Individual Room Air Conditioning Systems for large Multi-room Buildings

Basis of Comparison / Type of Unit	Fan Type Units			
	I  Non ventilating type	II  Ventilating type (low bldgs.)	III  Ventilating type (high bldgs.)	IV  Corridor fan type unit
1. Principal Fields of Application	Speculative or low-priced apartments hotels, or offices.	High-grade apartments, hotels, office buildings and hospitals, of 2 or 3 stories.	Same as II, but higher buildings.	Same as III
2. Control of Temperature a. Individual control, summer	Yes, by control cold water.	Yes (Same as I)	Yes (Same as I)	Yes (Same as I)
b. Individual control, winter	Yes, by control hot water	Yes (Same as I)	Yes (Same as I)	Yes (Same as I)
c. Ability to simultaneously heat and cool adjacent rooms	Nil, unless a 4-pipe system is used.	Good, within limits of outdoor air, and fan performance of given unit.	Limited because of smaller primary air volume.	Normally moderate, 100% if 4-pipe system is used.
3. Control of Humidity a. Summer	No, only incidental to cooling.	Same as I.	Same as I.	Same as I.
b. Winter	No.	Difficult because of freezeup problems.	Same as II.	Good.
4. Service Connections a. Wires	Yes, usually 110 volts.	Same as I.	Same as I.	Same as I.
b. Pipes	3, (supply, return, drain).	Same as I.	Same as I.	Same as I.
c. Comparative sizes of ducts	None.	Large. Necessary to cut outer wall.	Small. Necessary to cut outer wall.	Uses corridor as horizontal supply and return for ventilation and dilution only.
5. Relative Considerations a. Initial cost *	—	—	—	—
b. Operating cost *	—	—	—	—
c. All-round performance (A-Best)	D to E	C to D	C to D	B to C
d. Maintenance (A-Least)	C	C	C	B to C
e. Use of outside air for cooling in intermediate seasons	No	Yes (A)	Limited to primary air (C)	Limited, (C)
f. Small ducts or none at all (A-Best)	A	B to C	B	B
g. Least machinery in room (A-Least)	C to D	C to D	D (High pressure fan)	C to D
h. Degree of simultaneous heating and cooling capacity	None (E)	B to C (Good within limits of outside air) (Danger of Freezing).	Very limited (D) (Danger of Freezing).	B to C
i. Rate of odor dilution (A-Greatest)	None (E)	Good (B)	Poor (C to D)	Good (B)
j. Discharge grille noise level (A-Lowest)	C to D	C to D	C to D (Must have built-in sound absorber)	B to C
k. Likelihood of odor and disease germ recirculation between rooms	A	A	A	C to D
l. Least amount of rentable floor space (A-Least)	A	A	A	AA
m. Winter humidification (A-Best)	No	Not practical because of freezeup problems.	Not practical because of freezeup problems.	A
n. Least cutting and patching required for installations in old buildings (A-Least)	A	B	B	C to D
o. Relative demand for engineering skill (A-Most)	D	B to C	B to C	A to B
p. System stability (Air flow)	—	Depends on fan characteristics	Stable	Stable
q Supplementary comments	**			**

* Due to the fact that almost no installations have been made in four years and due to present confusion over wages and prices, no realistic ratings can be made at this time.

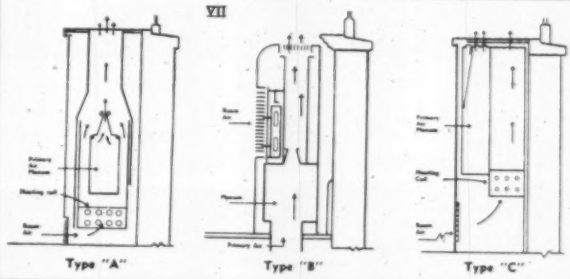
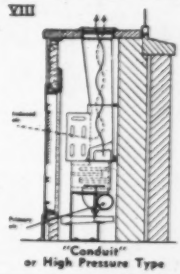
** 4-pipe systems, under 2c above have not been tried extensively and control devices are not highly developed. First expense of 4-pipe system obviously a disadvantage.

Comparison of Individual Room Air Conditioning Systems for large Multi-room Buildings

Type of Unit / Basis of Comparison	Self-contained Type Units	
	V  Window Type Portable	VI  "Special" Unit for High Bldgs.
1. Principal Fields of Application	For single offices or groups of offices, but seldom more than a few dozen offices in any one building. (Buildings not over 2 to 4 stories high)	Large office buildings, hotels, and apartments. (See Item 5q below)
2. Control of Temperature a. Individual control, summer	Yes, "on-off" only.	Same as V
b. Individual control, winter	Yes, by control of separate heating system (or use of reverse cycle type unit or electric strip heater, but only in southern United States).	
c. Ability to simultaneously heat and cool adjacent rooms.	Excellent.	Excellent.
3. Control of Humidity a. Summer	Yes, but only incidental to cooling.	Same as V.
b. Winter	No, unless provided by separate central system. Local office freezeup and maintenance of many sprays and floats make local humidification impractical.	
4. Service Connections a. Wires	Yes.	Yes.
b. Pipes	No drain in air-cooled models. 1 supply, 1 return, and 1 drain pipe in water-cooled models.	Same as V.
c. Comparative sizes of ducts	No ducts as such. Air openings mounted in lower half of window.	Small opening in wall as in Type III or small opening in lower half of window.
5. Relative Considerations a. Initial cost *	—	—
b. Operating cost *	—	—
c. All-round performance (A-Best)	C	B
d. Maintenance (A-Least)	D	D
e. Use of outside air for cooling in intermediate seasons	A to B (But subject to wide variation between rooms due to fan characteristics on this type of unit.	Limited to primary air. (C to D)
f. Small ducts or none at all (A-Best)	A	B
g. Least machinery in room (A-Least)	D	D
h. Degree of simultaneous heating and cooling capacity	AA to A if radiator heat continuously available.	AA to A if radiator heat available, or if supplementary heating coil is installed in unit
i. Rate of odor dilution (A-Greatest)	B (Good, but deposits of tobacco smoke on coil tend to offset this).	Poor (C to D)
j. Discharge grille noise level (A-Lowest)	C to D	C to D
k. Likelihood of odor and disease germ recirculation between rooms	A	A
l. Least amount of rentable floor space (A-Least)	A	A
m. Winter humidification (A-Best)	Impractical, because of maintenance of floats, drains, etc. and likelihood of freezeups.	Same as V
n. Least cutting and patching required for installations in old buildings (A-Least)	A	A
o. Relative demand for engineering skill (A-Most)	C to D	C to D
p. System stability (Air flow)	Usually very seriously affected by wind and by stack effect.	Stable
q. Supplementary comments		This unit was not available prior to the war, but is shown here to indicate its relative standing if such a unit is offered post-war.

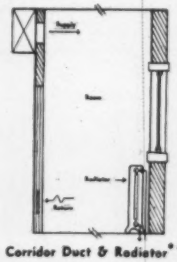
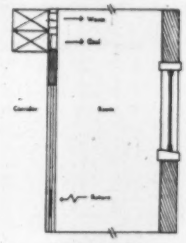
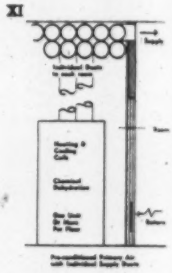
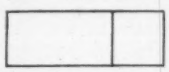
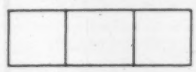
* Due to the fact that almost no installations have been made in four years and due to present confusion over wages and prices, no realistic ratings can be made at this time.

Comparison of Individual Room Air Conditioning Systems for Large Multi-Room Buildings

Basis of Comparison \ Type of Unit	Induction Type Units	
	VII  Type "A" Type "B" Type "C"	VIII  "Conduit" or High Pressure Type
1. Principal Fields of Application	Office Buildings. (Both large and small) Banking Spaces Hotels	Apartment Buildings Office Buildings Hotels Hospitals
2. Control of Temperature a. Individual control, summer	Yes, by control of primary air, or warm water for reheat.	Yes, by control of water flow only.
b. Individual control, winter	Yes, by control of water or steam flow.	Same as above.
c. Ability to simultaneously heat and cool adjacent rooms	In general very good. If warm water (or steam) is available in summer, this system provides the ultimate in simultaneous heating and cooling capacity.	Yes, but cold water must be supplied in intermediate seasons.
3. Control of Humidity a. Summer	Very good.	Very good
b. Winter	Very good.	Very good.
4. Service Connections a. Wires	No.	No.
b. Pipes	1 supply and 1 return.	1 supply, 1 return, and 1 condensate line.
c. Comparative sizes of ducts	Supply ▭▭ Return	○ Supply
5. Relative Considerations a. Initial cost *	—	—
b. Operating cost *	—	—
c. All-round performance (A-Best)	Generally A, but AA if summer reheat and adjustable discharge grilles.	A for hospitals, apartments, and hotels. B for office buildings.
d. Maintenance (A-Least)	A	B (because of nozzle and coil cleaning)
e. Use of outside air for cooling in intermediate seasons	A	C or D
f. Small ducts or none at all (A-Best)	C	A
g. Least machinery in room (A-Least)	A	A
h. Degree of simultaneous heating and cooling capacity	With hot water (or steam) and cold air, this system provides the ultimate in simultaneous heating and cooling capacity.	Usually satisfactory, but temperature reduction at night for sleeping room applications is limited.
i. Rate of odor dilution (A-Greatest)	A	C to D
j. Discharge grille noise level (A-Lowest)	B	A
k. Likelihood of odor and disease germ recirculation between rooms	Same as any conventional "central station" system (C to D)	Almost eliminated as far as air conditioning is concerned. (A to B)
l. Least amount of rentable floor space (A-Least)	C	B
m. Winter humidification (A-Best)	A	A to B
n. Least cutting and patching required for installations in old buildings (A-Least)	D	B to C
o. Relative demand for engineering skill (A-Most)	A to B	A to B
p. System stability (Air flow)	Stable without volume control. This system is much less desirable when volume control is used.	Stable.
q. Supplementary comments		

* Due to the fact that almost no installations have been made in four years and due to present confusion over wages and prices, no realistic ratings can be made at this time.

Comparison of Individual Room Air Conditioning Systems for large Multi-room Buildings

Basis of Comparison / Type of Unit	"Central Duct" Systems		
	IX  Corridor Duct & Radiator*	X  Dual Duct System	XI 
1. Principal Fields of Application	Used largely as an addition to existing office buildings, hotels, and apartments.	Large office buildings.	High-grade hotels and apartments.
2. Control of Temperature a. Individual control, summer	Yes, by air volume.	Yes, but by air volume which results in need for delicate static pressure control equipment	Yes
b. Individual control, winter	Yes, by radiator control.	Yes, by radiator control or by volume control of "warm" duct.	Yes
c. Ability to simultaneously heat and cool adjacent rooms	Good, provided radiator heat always available.	Very good.	Very good.
3. Control of Humidity a. Summer	Yes**	Yes	Yes, exceptionally good. (Uses chemical dehydration)
b. Winter	Yes**	Yes	Yes
4. Service Connections a. Wires	No, unless for automatic controls in each room.	Same as IX	Same as IX.
b. Pipes	Radiator supply and return plus control tubing.	Control tubing.	Control tubing, (occasionally radiators)
c. Comparative sizes of ducts			Individual 6- and 8-inch supply ducts to each room.
5. Relative Considerations a. Initial cost*	——	——	——
b. Operating cost*	——	——	——
c. All-round performance (A-Best)	B to C	A for office buildings. B to C for hospitals, hotels, apts.	A
d. Maintenance (A-Least)	A	A to B	A to B
e. Use of outside air for cooling in intermediate seasons	A	A	A
f. Small ducts or none at all (A-Best)	C to D	D	C to D
g. Least machinery in room (A-Least)	A	A	A
h. Degree of simultaneous heating and cooling capacity	A if radiator heat available. (D if not)	A	A
i. Rate of odor dilution (A-Greatest)	A	A	A
j. Discharge grille noise level (A-Lowest)	A to B	A to B	A to B
k. Likelihood of odor and disease germ recirculation between rooms	Maximum of Recirculation. (C to D)	D	B to C
l. Least amount of rentable floor space (A-Least)	C to D	C to D	B to C
m. Winter humidification (A-Best)	A	A	A
n. Least cutting and patching required for installations in old buildings (A-Least)	B to D	C to D	C to D
o. Relative demand for engineering skill (A-Most)	A	A	A
p. System stability (Air flow)	Unstable unless supplied with delicate control equipment.	Inherently unstable.	Stable.
q. Supplementary comments	When used with constant volume and individual reheaters, this makes an excellent system.		

* Due to the fact that almost no installations have been made in four years and due to present confusion over wages and prices, no realistic ratings can be made at this time.

** This system must be zoned to get results given below—with zoning either by fans or local zone heaters.

when the temperature gets too high, rather than turn off the radiator valve. Just let the building management install air conditioning, and this psychological quirk—if we can call it that—is magnified many times, and the occupants expect completely automatic temperature control during every minute of the working day.

C) *Variation in Standards*—In a large office building, in a large hotel, or in a large apartment building, we have hundreds and possibly even thousands of occupants. These occupants vary widely as to age; they vary widely as to the state of their health; there is considerable variation in the amount of clothing they wear. All of these factors result in many different ideas of what constitutes "comfort." The old fellow in this office was out late last night and his metabolism today is not at all comfortable for the red-blooded, two-fisted young sales manager in the office next door. The secretary in the next office may have still an entirely different idea as to what is a satisfactory standard of comfort. This matter of "variation of standards" is not something to be passed over lightly.

Volume of Complaints

D) *"Volume" of Complaints*—Even disregarding the proportionately greater number of occupants in the larger buildings, the points mentioned above make it obvious that the building management will receive a proportionately greater *volume* of complaints than will occur with most other types of air conditioning installations, and the system must be flexible indeed which has any chance of keeping this volume to a practical low level.

E) *Outside Space Versus Central Space*—Once Btu load sheets are made up for the individual offices, hotel rooms, and apartment rooms, the engineer may in many cases realize that outside factors of sun load and wall transmission represent a greater proportion of the total load than in the more conventional type of air conditioning installation. The greater the use of glass the more severe this problem becomes, with the result that the air conditioning system must be much more flexible in its capacity control than the systems installed in department stores, dress shops, industrial plants, etc. The trend to heavier illumination partially offsets this situation, but failure to examine this phase of the design problem carefully may result in the selection of a system which causes a never-ending series of complaints.

Taking all of the above points as a whole, the author believes that they point to a need for heating and cooling flexibility that is all too frequently overlooked by the designers of multi-room air conditioning installations. For that reason Items 2c, 5e, and 5h on the comparison charts represent points which should receive extremely serious consideration—certainly far more serious consideration than they have been given in the past.

Air Distribution

In general, many of the types of systems shown on the comparison charts will give highly satisfactory air distribution within the conditioned space. The hotel or office building that uses a corridor duct system with radiators under the windows generally gets as much satisfaction from the air distribution standpoint, as does the building with an induction unit placed under the window.

However, in the newer building —with the trend to lighter wall construction and larger glass areas —a larger and larger portion of the heating and cooling load is concentrated on the periphery of the building, and the placement of induction units or fan units along the outside wall assures a rapid heat exchange between the conditioning air and the room air, with the result that there is still less likelihood of draft complaints.

Maintenance an Important Factor

It goes without saying that the amount of maintenance is a most important factor in the selection of equipment for multi-room buildings. In general, this point argues against the installation of hundreds of self-contained air conditioning cabinets, each of which has its own motors, compressors, fans, filters, drains, etc., all of which are potential maintenance hazards.

The problem is not quite so severe with fan type units, and provided the corridor fan type unit is supplied with a quiet and long-lived fan motor, maintenance for such equipment should not be unreasonable. In general, low maintenance is in favor of some type of central duct system such as Systems IV, VII, VIII, IX, X, XI in the charts.

It may be observed generally that a dry finned coil picks up less lint and dirt within an office or hotel room than does a wet coil of the identical design. Therefore, in the case of induction units or corridor type fan units (systems using a finned coil in each room), the cleaning problem will be minimized if the primary air is passed through either mechanical dehumidification or chemical dehydration equipment.

While the prime objective of the author was the preparation of analysis charts for use in visual comparison and analysis of different types of multi-room air conditioning systems, certain general conclusions may be drawn.

Satisfying User Is Difficult

The problem of satisfying the user is more difficult in a multi-room air conditioning installation than it is with most other types of comfort air conditioning. Factors are present which call for far greater flexibility as to temperature control, with the result that sizable heating and cooling loads must at many times of the year be cared for simultaneously.

The problem of maintenance is such that, in general, most very large buildings can give serious consideration only to some type of central duct system with a minimum of mechanical equipment in the occupied spaces.

The complications are so numerous and the monetary value of the equipment involved is so great that any engineer, architect, or installing contractor who has not previously installed air conditioning in a large multi-room building should undertake an assignment in this field only after having given the problem very detailed study.

Since literally thousands of people will be exposed to the air conditioning in just one large hotel or office building installation, the engineering profession and the manufacturers of equipment should make special efforts on such installations to assure high standards of performance.

Flow Failure Control in PIPING CIRCUITS

By MELVIN A. RAMSEY

THERE ARE various methods of obtaining a pressure difference, varying with the flow, for providing safety control of piping circuits where failure or reduction of flow must be guarded against. Mr. Ramsey, of Arnott & Co., Buenos Aires, calls attention to such methods here, and describes examples he has used on installations. Careful consideration of the means for actuating a flow failure control may result in a somewhat lower circuit resistance, and may save a fair amount of power.

SAFETY CONTROLS to stop the refrigeration in case chilled water circulation is interrupted or reduced below the minimum safe amount, and for other piping applications, almost always use orifices and a differential pressure switch. Although, as a method of control, this leaves little to be desired it does result in an additional resistance in the circuit with a consequent increase in power required. The additional power is usually not great, but, if it is as much as 5 ft of water column as was the case in one installation, it might easily be more than 10 per cent of the total resistance. If, with little or no extra cost, this extra pressure loss can be eliminated, it certainly seems wise to do so.

To actuate a safety control by a pressure at a certain point in a fluid circuit would often provide no really sure means of protection. However, there are some cases in which it is a simple and dependable arrangement.

Water Circuit Comprising Cooler and Washer

One example is that of a water circuit including a cooler and a single washer. All the water which passes through the cooler goes through the sprays and the rate of flow is intended to be constant. Temperature regulation is by means of control over the refrigeration capacity. The pressure loss of the nozzles will be constant for the desired flow and the nozzles can well be used in place of an orifice with the simplification that the pressure at the outlet is always atmospheric and a standard pressure switch actuated by the difference between the pressure in the circuit and the atmosphere, replaces a more complicated one actuated by the difference between two pressures in the circuit.

This method was used as the flow failure protection for a cooler and washer circuit having a total loss of about 80 ft of water column when circulating about 1400 gpm. The loss through the 592 nozzles, at this rate of flow, is about 25 psi. A pressure switch, set to make contact at 15 psi, is connected to the pipe entering the washer. (Of course, there are no valves or other means of flow control between the pressure switch and the nozzles.) This control assures that the refrigeration cannot operate unless the flow is at least 75 per cent of that desired. Even with a not particularly sensitive switch, a control is provided which allows only a very small flow reduction without cutting off the refrigeration.

It may be suggested that the nozzles could become clogged. However, a strainer having much smaller openings than the nozzles is usually provided and it is difficult to imagine any larger portion of the nozzles becoming stopped at the same time. Doubtless such a method would be less foolproof if there were only two or three nozzles, but in the common installation having a relatively large number of nozzles, usual observation of the washer will assure that, before many stop functioning normally, they will be cleaned.

Closed Circuits

There are many circuits that are closed, so that there is no point where the differences between the existing pressure and the atmospheric pressure is necessarily dependent on the rate of flow. For this type of circuit a dependable control is the type which is actuated by a difference in pressure between two points in the circuit, of such a nature that the difference is dependent only on the rate of flow through the cooler. An orifice answers this requirement, but so, also, does any difference in pressures between any two points in the circuit which fulfill the following conditions:

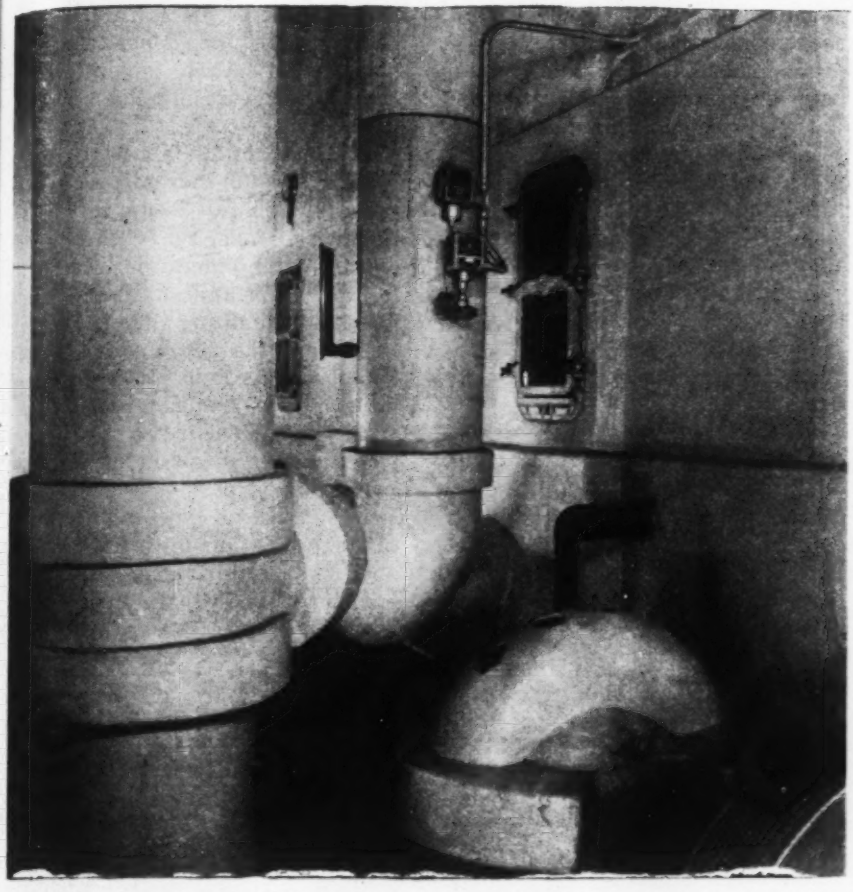
1) The fluid passing them is identical, and also identical with that passing through the cooler. There must be no bypass or other arrangement to permit changing this condition.

2) No valve of any kind exists between the two chosen points.

3) There is no reasonable possibility of resistance between the two points increasing by stoppage or other cause.

4) The two points should be on the same level and the circuit should not rise or fall between them. (If the two points are on different levels there is a possibility that they can be used, but careful consideration must be given to the arrangement of the circuit and the connections to the differential pressure switch, so that there is no chance that a partial filling of the system, or switch connecting lines, can have the same effect on the switch as a flow. Even if the points are on the same level, if the switch connecting piping rises or falls materially, the same consideration must be given to the effect of partial filling of this piping.)

Some of the requirements mentioned assume that the flow causes a pressure at the first point in



Example of flow control applied to an air washer, showing the control (pressurestat and thermostat) on the pipe coming down from the cooler

the direction of flow higher than that at the second point, as is the case where resistance causes the difference. There may, however, be points in the circuit where the pressure rises in the direction of flow. Such is the case where there is an increase in pipe size (in the direction of flow) by means of a properly designed diverging cone, in a horizontal part of the circuit.

Use of Diverging Cone

Very often the discharge of the pump is smaller in size than the circulating piping. In an installation recently made, the pump has a 3 in. suction and a 2 in. discharge, but the circulating piping is 4 in. This is probably an unusual difference but it is certainly not uncommon to have a pump with a 2 in. discharge when using 3 in. circulating piping.

The velocity of the fluid in the 2 in. pump discharge is about 2.2 times the velocity in the 3 in. pipe and, if the velocity energy is properly converted to pressure energy, there will be a greater pressure in the 3 in. pipe than at the pump outlet.

To illustrate the use of this arrangement for operating a differential pressure switch, consider a case where 100 gpm is to be circulated. Most standard pumps for a circulation of this amount, against an average resistance, have a 2 in. discharge. The circulating piping would probably be 3 in. The average velocity in the 2 in. discharge would be about 9.6 fps, corresponding to a 1.43 ft head. The velocity in the 3 in. pipe would be about 4.4 fps, corresponding to a 0.30 ft head.

Frequently, the change is made rather abruptly from the 2 in. discharge to the 3 in. pipe with a loss of as much as half of this difference of 1.43-0.30 or 1.13 ft of head. To convert practically all of this velocity energy into pressure energy, it is only necessary to use a cone with an included angle of divergence of 5 deg or less. Such a cone, for a change from 2 in. to 3 in., would be about 1 ft long. If this cone is properly made, the pressure in the 3 in. pipe would be at least 1 ft of liquid column greater than that at the pump outlet. The cone has thus served to conserve the head available to overcome the resistance of the liquid circuit and has made available two points, near together, where there is a definite pressure difference which varies with the rate of circulation. Between these two points the differential pressure switch can be connected, as shown in Fig. 1.

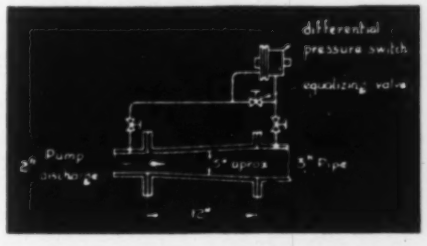
This method of connection for a circulating safety control seems to have definite advantages over an orifice.

First, it does not add any resistance to the circuit and, where it replaces an otherwise abrupt change in pipe size, it provides more pressure energy to overcome the existing resistance.

Second, it depends on a difference between pressures where the pressure increases in the direction of flow. Pressure differences, where the pressure falls in the direction of flow, have the defect that any increase in resistance over a period of time, caused by obstructions in the piping between the two points, would cause the same pressure difference with a reduced flow. The diverging cone after the pump would have its difference decreased by an obstruction in that section of the piping. Of course, the possibilities of orifice restrictions, in a reasonably well cared for system, are rather remote and it would certainly not be wise to go to great trouble to use another method. However, since the diverging cone after the pump is probably as low in cost and simpler, it seems the logical arrangement where conditions permit its use.

The actual difference which will be available, in the case of the diverging cone immediately after the pump, cannot be predicted exactly, for the same reason that an

Fig. 1—Diverging cone, showing connections to differential pressure switch



orifice or a venturi meter installed in such a location would not serve for accurate flow measurement. The only thing which is known is the approximate minimum available difference and, of course, the actual difference resulting is not likely to be so much greater as to pass beyond the range of the differential switch selected on the basis of the minimum available. If, in some remote case, the difference is too great for the switch, it is only necessary to move one of the pressure taps nearer to the other.

In the actual installation previously mentioned, the design called for a circulation of 106 gpm against a 66 ft head. The 2 in. pump discharge is expanded to 4 in. before entering the cooler. This requires a diverging cone about 2 ft long.

There is a bend of about 30 deg at the pump outlet before the cone begins, and immediately after the cone there is a 90 deg elbow.

The taps were taken off the concave side of the first elbow and the convex side of the second elbow, as shown in Fig. 2, in order to have available the greatest possible pressure difference for operating the switch. This was desired particularly in this case because it was originally intended to reduce the flow through the water cooler when the circulation through one of the two units supplied by the cooler was not required. Even with the lower flow, which would have given about 20 per cent of the normal difference, the differential switch was intended to make contact, so that it was best to have as large a difference as could be obtained. Also there was some doubt as to the sensitivity which would be available in the switch, since a standard one could not be purchased, because of war restrictions, and it had to be improvised from available materials.

The necessity of permitting reduced flow was eliminated by using a bypass which is opened enough to maintain flow through the cooler when the flow through the units is reduced.

As now adjusted, the control, which has two switches which operate in sequence, causes a light to go out if flow is reduced as much as 6 or 8 per cent to warn the operator that flow has been reduced and that a further reduction will cause the refrigeration to stop. (This occurs at a 10 to 12 per cent flow reduction.) If the reduction has been caused by his throttling of flow to one or both units, he must open the bypass sufficiently to again light the light. The light indicates practically full flow conditions and the refrigeration is stopped before flow is reduced to anything approaching the danger point.

Based on the 106 gpm, the difference in pressure between the ends of the 2 in. to 4 in. diverging cone should be about 1.5 ft of water column. Due to lower resistance in the water circuit than was expected, the flow is about 145 gpm. (This circulation rate is based on the manufacturer's pump performance curves which indicate a circulation of 145 gpm at the 48 ft head measured between the pump suction and discharge.) With this circulation, the pressure drop between opposite ends of the cone should be about 2.7 ft of water column. The amount measured, between the points shown in Fig. 2, is actually about 5.7 ft of water column. Thus the difference caused by uneven velocity over the 2 in. pump discharge and the difference between the inside of the 2 in. elbow and the outside of the 4 in. elbow is about $5.7 - 2.7 = 3.0$ ft of water column in this case.

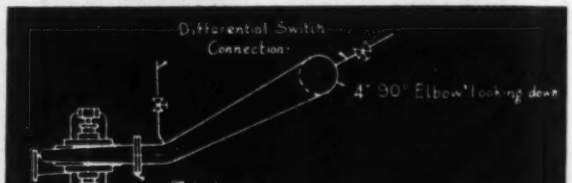


Fig. 2—Diverging cone and elbows, showing connections to differential pressure switch

Effect of Static Pressure Differential

If the diverging cone cannot conveniently be horizontal, that does not necessarily eliminate the possibility of using it. It merely means that the effect of the static head difference must be carefully considered, as was mentioned in the fourth requirement for two points where the difference is caused by resistance. The important consideration, in either the case of pressures decreasing in the direction of flow or increasing in the direction of flow, is that the static pressure must result in an increase or decrease in the same sense; or the static pressure changing in the opposite sense, must be less than the difference caused by the resistance or velocity change.

In a case of the static pressure difference and that due to resistance or velocity decrease changing in the same sense, the differential switch should be located at the low point and an arrangement provided for filling the connecting line from the high point to the switch. This is essential because an empty switch connecting line from the high point to the switch would result in an incorrect flow indication and a partially filled system, with no flow, might result in an indication of full flow.

If the switch connecting line mentioned is full, the switch will not fail to open in case of reduction of flow.

In the case of a static change in the opposite sense, but of a smaller value than the resistance or velocity difference, the location of the switch is immaterial because no partial filling of the main circuit or switch connecting lines could cause the switch to indicate a higher flow than actually existing.

As an example of the effect of a static pressure difference between the two points, consider the effect of having the cone shown in Fig. 2 in a vertical position with the 4 in. elbow 2 ft below the 2 in. elbow. The static pressure increases in the same sense as the dynamic difference. If the switch is installed at the level of the tapping in the 4 in. elbow and a connection left so that the line from the 2 in. elbow to the switch can be filled, there will be no way for the switch to make contact (when the connecting line is filled) unless the required flow exists. The column of water in the connecting

line acts in the direction to hold the switch open. The flow and static heads of 5.7-2.0 ft will be required to change the switch to the closed position. (For a resistance difference the same thing is true if the pipe is rising, instead of falling, in the direction of flow because, in that case, the static pressure decreases in the direction of flow and the resistance loss results in a decrease in the same sense.)

Now consider the case of the 4 in. elbow 10 ft above the 2 in. elbow. The static and dynamic pressure are now changing in the opposite sense, and the static difference of 10 ft is greater than the dynamic difference of 5.7 ft. If the switch connecting lines are full and the 10 ft of circulating line is also full, the switch will protect against circulation failure. However, if the level in the circulating line fell to a point 4.3 ft or less above the connection to the 2 in. below, and the switch connecting lines remained full, the switch would make contact, indicating full flow, although no circulation exists.

Since there appears to be no practical way of assuring that the partial emptying of the circulating piping will result in emptying the connecting lines proportionately, this arrangement with pressure changes in the opposite sense, with the static change greater than the dynamic change, must be accepted as an impractical safety control. (For a resistance difference the same thing is true if the pipe is falling instead of rising in the direction of flow because, in that case, the static pressure increases in the direction of flow and the resistance loss results in a smaller change in the opposite sense.)

The third possibility is illustrated by the 4 in. elbow being 2 ft above the 2 in. elbow. The static and dynamic pressures are now changing in the opposite sense, but the dynamic difference of 5.7 ft is greater than the static difference of 2 ft. In this case the fluid column in the connecting piping acts in the direction to close the switch, but the 2 ft difference is too small to cause it to close. The only way to get the additional 3.7 ft required to close the switch is a flow of the desired amount in the circulating line. The only important consideration in such an arrangement is that the switch be sensitive enough to open if the difference falls from the dynamic difference to static difference, which in this case is from 5.7 ft to 2 ft.

Since no partial filling of either circulating or connecting lines could cause the 5.7 ft difference, this provides an excellent safety control. (For a resistance difference the same thing is true if the pipe is falling instead of rising in the direction of flow because, in that case, the static pressure increases in the direction of flow and the resistance loss results in a greater change in the opposite sense. In the case of a resistance difference, this is hardly likely to occur, unless the piping has a small pitch down or a long horizontal run with only a small vertical drop, because a vertical line with pressure falling in the downward direction of flow is hard to imagine in a properly designed circulating piping system.)

Pressure Difference Between Concave and Convex Sides of Elbows

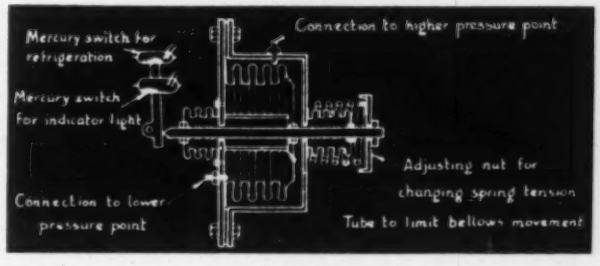
The difference between pressures taken on the concave and convex sides of the same elbow may also be used to actuate the differential pressure switch. Data on pressure differences between the inside and outside of a 90° elbow in a 6 in. pipe were given in a paper presented at an annual meeting of the American Society of Heating and Ventilating Engineers.* In the particular elbow used and for the range of velocities given, the difference between the two pressures was about 1.6 times the pressure corresponding to the velocity head based on the average velocity in the 6 in. pipe. Unfortunately, the author has no other information on pressure differences between the convex and concave sides of elbows, but it seems probable that sufficiently great differences can be obtained for operation of a switch.

A switch sensitive to very small differences, but still satisfactory for high static pressures, is not very difficult to make, provided it be connected as shown in Fig. 1 and the bypass opened before either of the valves connecting to the system is opened or closed. The bypass must never be closed unless both valves are open.

The switch shown in Fig. 3 serves well for static pressures of 100 psi. It is about 8 in. overall diameter and will operate with a variation in the differential of only 7 in. water column.

The main bellows is limited in movement by the tube in the center and the casing, to give as much protection as possible against accidental application of static pressure to one side only because of improper operation of the valves.

Fig. 3—Differential pressure switch


Mercury switch for refrigeration
Mercury switch For indicator light
Connection to higher pressure point
Adjusting nut for changing spring tension
Tube to limit bellows movement
Connection to lower pressure point

This article is not intended to be a criticism of the use of orifices in general for operation of differential safety switches. The desire in presenting it is to call attention to the fact that there are other means for obtaining a pressure difference, varying with the flow, which may result in less or no additional pressure loss in the circuit and may require the installation of no extra material.

To the means mentioned for obtaining pressure differences varying with flow, should be added the venturi meter, which is easy to construct and results in less actual loss of pressure than an orifice which makes available the same pressure difference with a given flow.

Careful consideration of the means for actuating a flow failure control may result in a somewhat lower circuit resistance and, in the case of a large system, save a fair amount of power.

*Friction-Heads in Standard Six-Inch Pipe, by F. E. Giesecke and J. S. Hopper, ASHVE Journal Section, Heating, Piping & Air Conditioning, February 1941.

"OPEN FOR DISCUSSION"

Air Conditioning Requirements for Workers in Factories

THE EDITOR—I must apologize for the delay in writing you about Walter L. Fleisher's comments on air conditioning requirements for workers in factories in the "Open for Discussion" section of the May HPAC.

I was much interested in Mr. Fleisher's statement that our "analyses were based on the assumption that a psychological response is a good basis of determination for a design condition of industrial air conditioning requirements rather than a physiological one."

Standard of Comfort

This may be partially true since the standard of comfort chosen was to provide conditions comfortable to 75 per cent of the workers on the average summer day. However, the data reported by the ASHVE's research laboratory in the past have all shown that an increase in the degree of physical activity requires a lower effective temperature either to provide optimum comfort, or to avoid undesirable physiological effects. Thus, in Fig 1 from page 386 of the July 1945 HPAC and reproduced here, which summarizes the above research data, the optimum effective temperature at a 400 Btu per hr metabolic rate is shown as 71 deg, while the maximum permissible effective temperature is about 88 deg. If the degree of activity is increased to 800 Btu per hr, however, the condition for optimum comfort reduces to less than 60 deg ET, while the maximum permissible has also lowered to about 84 deg ET.

The point I am making is that whether our analysis is on a psychological (i.e., optimum comfort), or physiological (i.e., maximum permissible effective temperature) basis, the ASHVE's research program has indicated that an increase in the degree of physical activity demands a lowering of effective temperatures within the working space. This does not seem to me to be consistent with Mr. Fleisher's contention that a 78 deg ET is suitable for an industrial worker doing heavy labor, while a 71 deg ET is required for light office work.

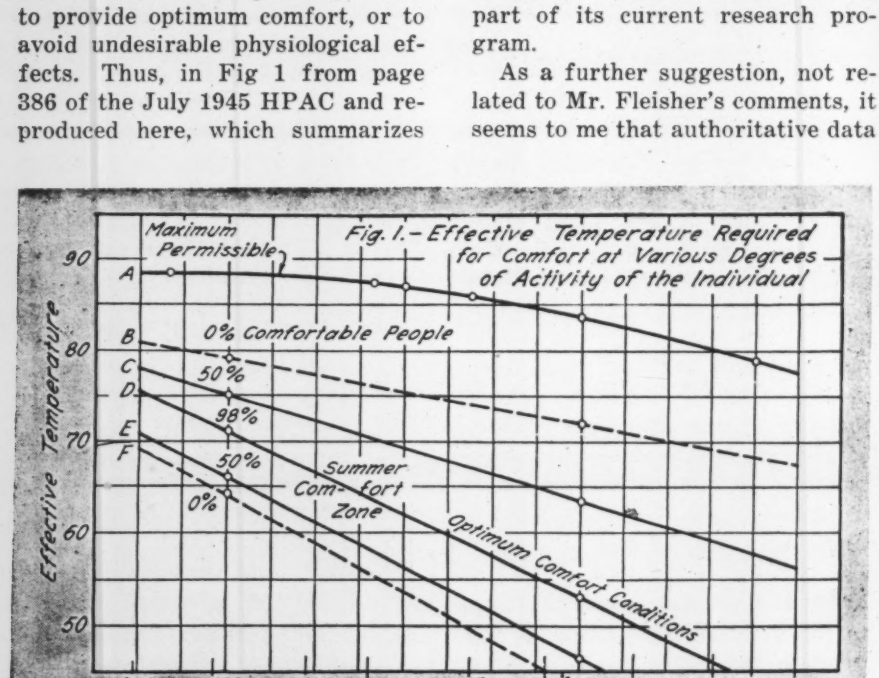
I suggest that the resolving of this inconsistency in the published data of the ASHVE could well be a part of its current research program.

As a further suggestion, not related to Mr. Fleisher's comments, it seems to me that authoritative data on the three following research projects would be of general interest to engineers concerned with the field of air conditioning:

1) Under what conditions, and to what degree, is worker efficiency improved by comfort air conditioning.

2) A quantitative study of the effect of comfort conditioning on the health of workers, and on absenteeism for causes other than health.

3) The physiological effects of "thermal shock" resulting from entering and leaving air conditioned spaces.—H. A. MOSHER, engineering unit supervisor, Eastman Kodak Co.



BALANCE FANS BOTH STATICALLY, DYNAMICALLY

THE EDITOR—There appeared on page 168 of the June HPAC an interesting illustration of a girl balancing a fan. We would like to point out, however, that she is only static balancing these fans. Practically every fan and blower manufacturer today knows quite well that, in many instances, static balancing is worse than no balancing at all. The reason for this is that the weight may not be put along the axis at the right location and thus will create a dynamic unbalance.

Fans and blowers should be statically and dynamically balanced, and we therefore offer the recommendation that should such illustrations or articles appear in the future, that it might be well to indicate whether static balancing, dynamic balancing, or static-dynamic balancing is referred to.

As one manufacturer of industrial dynamic balancing machines we felt that you would like this information and to further advise that it is not uncommon for manufacturers having dynamic balancing machines to balance this many or more fans or blowers and do the job completely by dynamic balancing instead of just static balancing.—MAURICE J. ELDRIDGE, industrial div., Bear Mfg. Co.

What's Wrong (If Anything) With the Construction Industry?

THE EDITOR—Since writing the articles relative to the construction industry which you published in the April and May issues, we have accumulated so many new problems, especially on increasing costs in other businesses, that we don't hear much more of the construction restrictions. I appreciate the comments offered by John Howatt in "Open for Discussion" in May, and I heartily agree with him that there are many things that can be done to improve the construction industry. Actually, however, I see very little effort being made in this direction.

Shortage of materials has held construction back and insofar as prefabricated housing is concerned, these manufacturers seem to be almost helpless to get anything together which can be counted on as volume production.

Some of the building people think that OPA ceilings have been an obstacle to production of various strategic materials, particularly lumber, bricks, tile, etc. Building costs are going up and labor rates will be still higher. As I write this, OPA has passed out of the picture and we won't know for some time what effect this has on building materials.

Poor Publicity Program

I have had a number of people thank me for presenting some of the ideas expressed in the articles—particularly the point as to what contractors are supposed to do and for what they get paid. I think we have suffered from a very poor publicity program, as the construction industry is so widely divergent and so highly competitive that we have never tried to get our story collected to present to the public. Many people look on the professional architect as an unnecessary expense and on contractors as equally unnecessary. They would like to buy housing off the shelf in the department store.

Can you imagine what our residential district would look like if we end up by accepting standardized package prefabricated houses instead of the more personal units that have been previously designed and built by the regular construction trade? People just don't like houses stamped out in thousand lots like automobiles; they won't live in them, except to rent them.

Need Multiple Housing

As a matter of fact, what basis is there for saying that we need 2,700,000 individual homes for veterans? I think we will find most of the veterans want to rent a simple, inexpensive, fireproof, sanitary dwelling, but when they come to buy something, they will want a better home that expresses their own individuality. Multiple housing units, starting with the eight-family apartment and running up to entire apartment communities, may be a much better answer to the housing shortage than trying to depend on individual small cheap homes. You simply can't buy a lot and build a small house on it for anywhere near the cost that you can build multiple family dwellings. Here is where the emphasis should be placed in getting materials.—LESTER T. AVERY, president, Avery Engineering Co.

ROLE OF ENGINEERS IN "HUMAN ENGINEERING"

THE EDITOR—Ralph Martin McGrath's article on Job Evaluation and the Heating, Ventilating, and Air Conditioning Engineer, published in the July HPAC, has been read with profound interest.

Need for Better Definition

It appears to me that there is need for better definition of the scopes of work covered by industrial hygiene engineers, industrial hygiene chemists, and job evaluation engineers. Certainly the job of "human engineering" (which term I dislike fully as much as does Mr. McGrath) as conducted today comprises an appraisal of the noise, temperature, humidity, dust, fume, mist, gas, vapor, radiant energy, and defective illumination hazard or nuisance by the industrial hygiene chemist and the industrial hygiene engineer, and the control of these objectionable conditions by the industrial hygiene engineer and the plant engineering department.

Industrial Hygiene and Plant Engineers

Frequently an atmospheric health hazard from dust or other atmospheric contaminant is controlled by a means other than ventilation or air conditioning, and for this reason the heating, ventilating, and air conditioning engineer plays a much less important role in human engineering than do the industrial hygiene engineer and plant engineering personnel.—ALLEN D. BRANDT, Sc.D., industrial hygiene engineer, Bethlehem Steel Co.

HEAT RELEASE FIGURE FOR STOKER FIRING TOO HIGH?

THE EDITOR—I can find nothing which I would seriously criticise in Lloyd L. Connell's paper, Stoker Industry Aids Smoke Abatement Work, published in the July HPAC. One should realize that a code represents minimum requirements and not maximum requirements. I do not believe that any code of this character should be adopted by all communities. It can be adapted to conditions that exist in each community.

It is my belief that the heat release figure as advocated by the Stoker Manufactures' Association is too high.—RAYMOND R. TUCKER, department of mechanical engineering, Washington University; formerly smoke commissioner of St. Louis.

WHEN ENGINEERS gather to hear a paper or talk, there comes a time when the meeting is thrown "open for discussion." We follow this custom in these columns, which provide an opportunity to comment on articles published; discuss other topics of interest to heating, piping, and air conditioning engineers and contractors; ask questions; make suggestions, etc.

Using the Reverse Cycle for Heating, Conditioning

By G. E. CLANCY

THERE ARE two definite sources of loss in compression refrigerating systems which prevent realization of the ideal performance ratio as stated by Carnot, and implied in the second law of thermodynamics for a temperature lift from one level to another. Here, temperature lift is to be regarded as that from the actual evaporator temperature to the actual condensing temperature, and does not include losses in temperature level necessary for heat transference, either in the form of temperature gradients in walls of vessels and other intervening media, or from the temperature rise or fall in heat carrying vehicles.

These losses are not entirely unavoidable, but they are of such a nature that it is unprofitable and impractical to add the additional mechanical complexities necessary to eliminate them. Moreover, even with this accomplished, the apparatus for such recovery would probably introduce additional mechanical losses which would, in the overall effect, cancel the gain!

Losses in Ideal Cycle

These losses are due to:

1) Isodynamic (constant total heat) expansion of the liquid to the evaporator from the condenser, instead of adiabatic expansion. If the expansion were adiabatic, and if the work of expansion were all reclaimed and used to help the compressor, this loss would not occur. But apparatus for this purpose would be expensive, and not completely efficient. Likewise, as the loss is comparatively small, such recovery is seldom attempted except in the case of dense air machines where it is absolutely necessary.

In general this effect becomes larger as the latent heat of vaporization of the refrigerant becomes lower. This effect is more exactly related to the ratio of latent heat of vaporization to the specific heat of the liquid.

2) Compression to temperatures higher than the equilibrium temperature of the vapor at the condensing pressure. Recovery of this loss would call for heat extraction during the process of compression, instead of after compression.

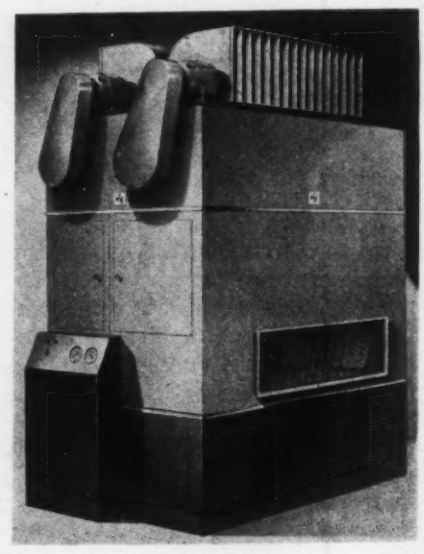
The second loss is usually more pronounced in a case where the refrigerant has a high latent heat of vaporization.

While the total of the two losses is not the same for all refrigerants, it does not vary greatly in the case of those in common use. But the ratio of the losses does vary quite widely.

For any system with a given displacement, hence a constant volume and mass of vapor handled per unit of time (the condition of pressure and volume before compression not being changed by these effects), the first loss is largely a loss of refrigerating capacity. The second loss, however, is all a loss of power with no theoretical change in capacity.

It seems advisable to consider subcooling and superheating individually before discussing a combination of the two effects, which is a condition frequently met.

Packaged heat pump unit



Subcooling

There are several ways by which subcooling may take place: (1) There is always a temperature difference between the condensing temperature and the condenser heat removing medium (usually water or air). If such were not the case, there would be no flow of heat. Also, there must be a rise in temperature in the vehicle which carries the heat away. So it is possible to extract the comparatively small amount of heat to be removed in subcooling with the condenser heat removing vehicle before it goes to the condenser, without raising its temperature enough to affect materially the condensing temperature. By this means the liquid temperature can be brought quite close to the temperature of the incoming vehicle. Or other supplies of the same vehicle may be obtained for this purpose.

If, in the first instance, the amount of condensing vehicle is increased sufficiently so that there is no rise in condensing pressure, hence temperature; or if, in the second case, none of the flow of the vehicle is taken from the condenser circuit, the subcooling will constitute a gain in capacity without any thermodynamic losses attendant to it.

This increase comprises an equal quantity gain. Herein all the heat being so extracted becomes evident in an equal increase in the amount of refrigeration per unit weight of liquid handled. Obviously if the liquid were not subcooled, part of the refrigerating effect would have to be expended in doing this cooling of the liquid. True, the amount of theoretical power regain-loss has also decreased, but we had no intention of reclaiming it. It would be wasted in either case.

1) The amount of such gain is inversely proportional to the ratio of the latent heat of vaporization to the specific heat of the liquid.

2) If some cooling medium, such as air or water which would otherwise be wasted from the refrigerating process, is available, but not in sufficient quantity for, or usable in, the condenser, it might

THE HEAT PUMP, or reverse cycle refrigeration, for heating buildings in winter—the same equipment being used for cooling in summer—is attracting renewed interest at the present time. Research studies on sources of heat for the cycle and other design details are being made, and lines of packaged heat pump equipment have been developed. In the April HPAC, Mr. Clancy, engineer with Drayer-Hanson, Inc., discussed the fundamentals of the scheme, and in June he considered heat sources. This month, he writes on effects of subcooling and superheating in refrigeration.

be used for liquid subcooling. In this case the gain is the same as in the preceding paragraph, but the limit is the temperature of the auxiliary vehicle, rather than that of the incoming condensing vehicle.

3) If the liquid line runs for some distance through an atmosphere having a temperature different from that of the liquid leaving the condenser (or water cooled subcooler located at the condenser), it will tend to acquire a temperature approaching that of its surroundings. Here a correction must be made for this effect, either up or down, gain or loss. (Exception: Where the liquid line runs through refrigerated space, in which case the liquid is cooled by loss of refrigerating effect, so that in the calculation of overall system performance, the liquid temperature must be assumed as being that of the liquid entering refrigerated space.)

4) All subcooling is a direct equal quantity gain in capacity, provided it does not give up its heat to the other portions of the cycle, thereby absorbing refrigerating effect, which would otherwise be useful.

Superheating

The refrigerated space, or product, is always at a higher temperature than the evaporator, and to a lesser extent so is the refrigerating vehicle. Also in some cases certain parts of the system may require refrigeration at a higher temperature level, so that the vapor leaving the evaporator may acquire more heat (superheat) and thus produce a greater refrigerating effect per unit weight of refrigerant circulated. This gain is not, however, an outright gain in equal quantity, unless it avoids losses of heat in transit to the compressor (such as an uninsulated section line of some length).

Generally, superheating has a tendency to reduce the capacity for a given net displacement when the latent heat value is large, such as in the case with ammonia, and to increase the capacity for a given net displacement, when the latent heat value is comparatively small, as is the case when "Freon 12" is used.

If the two effects are combined and interrelated by the use of a heat exchanger, we may conclude from a theoretical standpoint that:

1) A slight gain may be made in capacity when such refrigerants as "Freon 12" are used.

2) Heat exchangers may help avoid loss of refrigeration by the suction vapor in transit.

3) There is no thermodynamic gain to be realized from superheating, and it is a loss in the case of such refrigerants as ammonia.

4) The major determining factor is the ratio of specific heat of the vapor to the latent heat and the absolute temperature in the case of superheating.

5) The gain which is possible for any specified number of degrees of subcooling is inversely proportional to the ratio of latent heat of the vapor to specific heat of the liquid, the gain being about twice as large for "Freon 12" as for ammonia under the same conditions.

6) Any subcooling which can be effected without absorbing refrigerating effect that would otherwise be used, or which absorbs refrigerating effect which would otherwise be lost or wasted, is a very desirable gain made without expenditure of power or increase in the size of the compressor.

Performance Factors Which Can be Obtained Practically with Well Designed Plants

Type	Heat Supplying Vehicle Entering Temperature Water or Air	Performance Factor Without Fan or Pump Power	Performance Factor Including Fan or Pump Power	Btu. per Kw Input
Heat absorption from outside air delivery direct to air....	30°	4.3	3.5	12,000
	40	4.4*	3.6*	12,300*
	50	4.5*	3.8*	13,000*
	60	4.7*	4.0*	13,700*
Heat absorption from water delivery direct to air.....	40	5.2	4.77	16,400
	50	6.56	5.86	20,000
	60	7.01	6.2	21,200

The above figures are based on 70 per cent compressor efficiency and 80 per cent motor and drive efficiency. Pumping is based on 50 ft total head with "wire to water" efficiency of 50 per cent. All include allowance for subcooling of liquid refrigerant by heating make up air with it.

In comparing performance with combustion heating, it should be noted that the heat application as herein stated is complete, essentially 100 per cent, whereas the application of combustion heating (especially where a large excess of combustion air is usd) is seldom over 70 per cent efficient.

Power for circulation of conditioned air has not been included. It would be necessary with almost any modern plant. However, the cost of power for the air circulating fan would be greater with a combustion heating system because of less advantageous power rates.

*These performance factors are based on a system designed to balance the operation at 30 F. If the minimum temperature balance for which the system is designed is higher, the performance would be somewhat greater.

Effect on the Equipment

So far we have considered only the heat gains and losses without considering the actual mechanical equipment that handles the refrigerant.

Subcooling has very little effect on the operation of various parts of the plant except:

1) It may give smoother expansion valve operation and will slightly increase the expansion valve capacity.

2) There may be some effect on the evaporator due to a smaller amount of flash gas.

In the case of superheating it isn't quite so simple:

1) Suction gas which seems dry saturated is not in all cases actually dry. There may be some small amount of liquid carried along, either in the form of fog, or in slugs too small to cause apparent trouble (knocking) in the compres-

sor. A little superheating is a good precaution against this.

2) Even though the vapor were to reach the compressor in a dry saturated state, the cold gas may increase somewhat in volume by contact with comparatively warm cylinder walls, valves, manifolds, etc.

3) Lubrication may be better with higher temperature suction vapor. This is especially true in the case of low temperature systems.

4) A considerable amount of superheat will often raise the discharge temperatures to an undesirably high level, which in turn will cause valve warpage, carbon formation on valves, lubricating troubles, and noncondensable gas formation. This is especially true in ammonia systems.

If superheating is desired, it can (in most cases) be better and more economically accomplished by some superheating device built for that purpose, than by starving the evaporator — which is built for evaporating and *not* gas warming.

A heat exchanger is not a cure-all for plant ills, and it cannot be given a rating of "so many per cent increase" in plant capacity. Such evaluations must be calculated in each individual case.

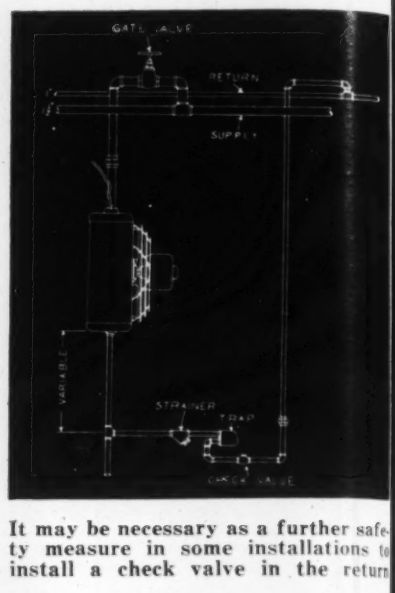
Intelligent study of these effects, and the inclusion of suitable selected equipment in the plant layout, based on the studies, can do much to increase plant performance, efficiency, and user satisfaction.

Proper Condensate Elimination Is Vital to Unit Heater Performance

A MAJOR source of corrosion within a unit heater is the incomplete evacuation of condensate. Air, upon coming in contact with condensate remaining in a unit heater, forms carbon dioxide and corrosion is promoted.

This situation is often found in installations where high pressure steam is employed and where condensate must be lifted to return lines above the unit. During normal operating periods, high steam pressure makes possible the rapid and complete removal of condensate since this pressure is sufficient to lift the condensate to return lines. However, when the pressure is decreased or shut down entirely, the last volume of condensate will not be lifted to the return but will remain in the return branch adjacent to the unit and—unless precautions are taken—will seek its own level within the unit.

One method of combating this situation is by applying the principle that water seeks its own level. For this reason ample space should be allowed for the last volume of condensate in the return branch *below* the unit itself. This prevents the last volume of condensate from backing up into the unit and causing corrosion in the return header or lower portions of the condenser tubes.



It may be necessary as a further safety measure in some installations to install a check valve in the return

A steam trap having the proper capacity and kept in good operating condition performs one of its primary functions in preventing the return of condensate. As a further safety measure, it may be necessary in certain installations of this type to install a check valve in the return branch. — ROBERT V. WILLIAMS, Modine Mfg. Co.

WAA OFFERS SURPLUS VALVES AND FITTINGS

Surplus valves and pipe fittings, which originally cost the government upwards of 100 million dollars, are offered to all classes of purchasers, including priority claimants, in a new national sales program, the War Assets Administration announced August 2.

The inventory includes commercial, industrial, Navy, Maritime, and other special types of valves and pipe fittings. The Navy types include many items that are adaptable to industrial and commercial piping applications.

The standard commercial items, approximating one-third of the total inventory, will be sold at fixed prices based on jobbers' current net cost less 40 per cent discount, f.o.b. location, according to the announcement. The balance, or special types, will be offered on a sealed bid basis.

The valves, made of steel, bronze and cast iron, include a full range of pressure ratings. Gates, globes, and checks are represented in all categories.

The fittings, of steel welding, cast steel, malleable iron, bronze and cast iron, come in all pressure ratings from 100 to 3000 lb.

Lot sizes will be established in order to attract the greatest number of potential buyers.

All sales will be conducted by WAA's 33 regional offices, and prospective purchasers are invited to inspect the inventories.

YORK CORP. PRODUCTION "AT HIGHEST RATE"

In anticipation of more stable conditions in the near future, and with a heavy backlog of unfilled orders, the York Corp. has increased the number of its production employees by 31 per cent over a year ago, according to S. E. Lauer, president, in the corporation's nine-month stockholder report. This is the highest rate of employment in the company history and production is at its highest rate, including the war period.

A large part of production, however, is going into work in process resulting in products and systems in various stages of completion, a large portion lacking only a few short items before shipment.

Use Tank or Tankless Type of Water Heater?

R. A., *a reader of Heating, Piping & Air Conditioning, asked this question in our July issue:*

"I have been told that in hard water areas there is more likelihood of encountering trouble with a tankless type of water heater than there is with a tank type. It doesn't seem to me that there should be any particular difference between the two types on account of water hardness, but I'd be interested in learning of any experience on this point or having comments from other readers of HPAC giving their ideas."

The following answers to R. A.'s question have been received for publication:

COILS LIME UP

IN A TANKLESS coil, water is heated close to the boiling temperature, sometimes over long periods of time, and when it contains considerable quantities of lime and minerals, these build up on the inner surface of the copper tubing in a state of marble hardness.

In a tank heating coil this does not take place as easily, since the water therein really never has a chance to boil out the substances. However, in cases where there is a large coil heating a small tank, such a coil also will lime up.

Direct fired cast iron, and even steel hot water heaters are also subject to damage where there is such really "hard" water. A heavy coating builds up within, diminishing heat transfer, whereupon the casting will overheat, burn away, and split.

There have been tankless coils made of a construction where short parallel copper tubes are set into sheets that are accessible to a cleaning tool. If these tubes are scraped clean at regular intervals before a heavy crust can form, the coil may be maintained at it's original usefulness for a long time. Such coils, of course, are intended for larger installations only, such as apartment buildings, where there is a regular attendant taking care of them.

In order to illustrate what "hard" water may do, I'd like to mention a job we had to do with some 10 years ago. This was a 3000 gal hot water storage tank heated with a submerged coil to which steam was supplied during the winter from one of the house heating boilers and in the summer from a separate steam boiler.

Hot water delivery abruptly ceased. On pulling out the coil, which was made of 140 ft of 1½ brass pipe, some slight incrustation was found at its outside which could not possibly have made a difference. But when the coil was cut apart, there was another story. It was completely clogged inside with a white, stonelike substance. The explanation: Joints in the coil had leaked slightly and the city main pressure had introduced water from the tank into the coil. This water had been boiled and evaporated by the steam in the coil, boiling out the minerals and depositing same inside the pipe walls.

It would appear that the critical point is reached when such water begins to boil.—W. O.

ASKS FOR FIGURES ON SNOW MELTING COILS

YOU ARE *invited to submit an answer to the following question from P. G. about snow melting coils for publication in these pages. Suitable answers will be paid for at regular rates, with additional payment for sketches. You are invited, too, to send us a question about heating, piping, or air conditioning for publication here.*

"In a recent article, it was mentioned that it was the usual practice to design radiant heating coils for snow melting for a snowfall of 1 in. per hr. I should like to know how many Btu per hr is equivalent to 1 in. per hr of snow, whether these rates are different for different parts of the U. S. (and where data on this point are available), and what efficiency is assumed in transforming inches per hour of snow to coal consumption."—P. G.

THEORETICALLY NO DIFFERENCE

THEORETICALLY there should be no difference between a storage or tankless type water heater. The storage type might not appear to lime up as quickly as the tankless type due to a smaller heating capacity and more area exposed to the water for lime deposit.—R. H. A.

A MATTER OF OPERATION

WE PRESUME this question is intended to mean any heater of the instantaneous type which would not have any real storage capacity, and we will consider it from that angle. We mention this because the word "tankless" has been applied to a certain type of instantaneous water heater installed under the water line of a boiler rather than for operation with steam.

It is probably true that in the presence of hard water it is possible to encounter more trouble if the scale is thrown down inside of the tube rather than outside of the

tube. Our own impression, however, is that difficulties from scale formation are related less to the matter of type of heater than to a question of indifferent or careful operation. A great deal of scale formation can be avoided by proper automatic control of the water temperature, and in some cases by avoiding the use of steam at high temperatures when a lower pressure steam might just as readily be employed.—E. A. H.

PROBABLY RIGHT

R. A. IS PROBABLY right in saying that in hard water areas, more trouble is experienced with a tankless heater than with a tank heating type.

This is because during a "no draw" period the water in a tankless heater coil gets almost as hot as the boiler water itself, and this with 5 lb of steam pressure on a boiler means approximately 227 F temperature. Of course, precipitation begins in most hard water at 140 F on up. In the storage type of heater there is less chance of these extremely high temperatures being experienced.—R. E. M.

LIME INSIDE TUBES

WE ASSUME R. A.'s reference to a tankless water heater is to the type where coils are immersed inside a steam boiler below the water line. This being the case, and with the domestic water necessarily flowing through the tubes, hard water will lime up the inside of the tubes, making the orifice progressively smaller and restricting the flow. When the tubes have to be cleaned, which is rather frequently, it is necessary to shut down the boiler.

When a steam or submerged boiler water coil is inside a storage tank, the domestic or hard water is on the outside of the coils. The chief precipitation in this case is on the sides and upper section of the tank, where the water is hottest. If the outside of the coils need to be cleaned, it is a simple matter to do so by going in through the manhole. There need be no shutting down of the steam boiler during this operation.—H. I. M.

PRACTICAL POINTER

Simple Attachment for Cutting Pipe

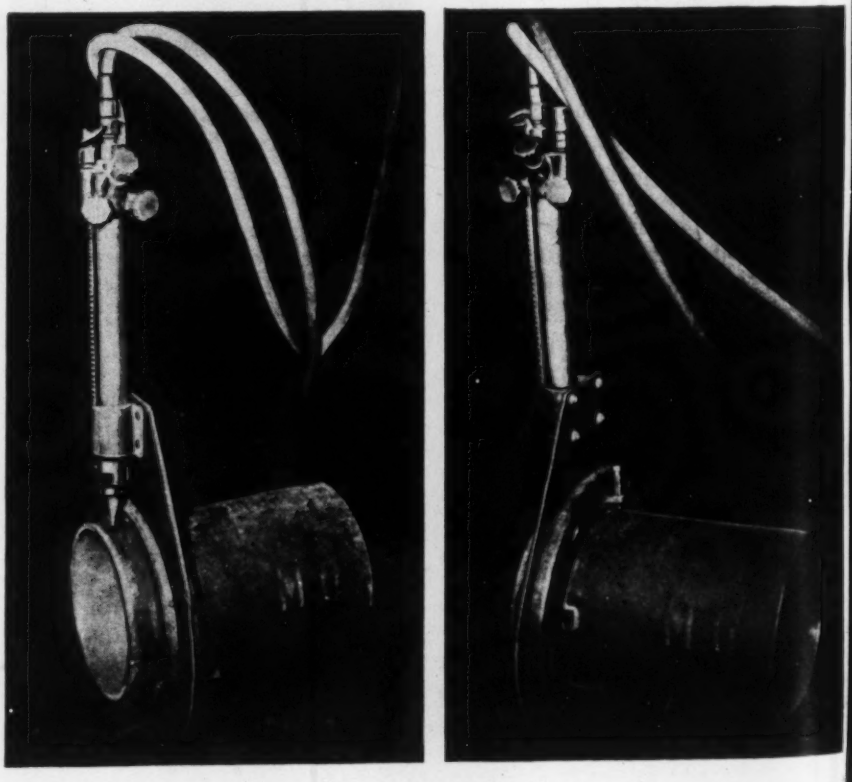
IT TAKES an experienced operator with a steady hand to make a good square cut on pipe. He must follow the line of cut around the pipe, maintain the proper speed, and keep the nozzle at the correct distance from the work. With the attachment illustrated here, he has only to control the speed. The device guides the blowpipe in a true line; the nozzle is kept at constant distance from the work.

The base of the guide is a pipe flange that slips easily over the size of pipe to be cut. If the flange is too loose, steel shims can be welded to the inside at three equidistant points. A boss welded to the flange has a setscrew to prevent the flange from slipping on the pipe. A collar cut from a piece of sheet steel is slipped on the pipe flange. The collar should fit so that it can be rotated around the flange without binding and yet not be too loose. Pins welded to the pipe flange prevent the collar from coming off. A blowpipe holder is made by bending a scrap piece of the sheet steel around the blowpipe like a clamp and bolting it to the wide part of the collar.

In operation, the guide is placed on the pipe to be cut. The pipe flange stays in one position, and the rest of the attachment is rotated around it.

A device of this kind works best when used only on one size of pipe. It is particularly useful to the small shop that has infrequent occasion to cut pipe of one specific size, or that has a quantity of cuts to make all at once.

This pipe-cutting attachment was made from a discarded pipe flange and a piece of sheet steel Courtesy Linde Tips



Selecting Roof Ventilators

C. R. Gelert Stresses Importance of Ratings, Describes Calculations for Typical Example

DESIGN conditions for the particular locality and ratings of the equipment to be used must be known accurately for satisfaction with natural draft roof ventilation, says Mr. Gelert, of the C. R. Gelert Co., here. He concludes by giving details of the selection of ventilators for a 35,684 sq ft area.

THERE are essentially two methods by which ventilation can be accomplished—forced and gravity. Let us consider ventilation by means of natural draft ventilators in this article, and ascertain how to get it—and to be sure that we get the ventilation we need. That means that the design conditions which were stated are the conditions encountered; that the calculations are accurate and in accordance with the best accepted practice; that the equipment selected was installed properly; and, last but not least, that the equipment will perform the task to which it is put.

"Design Conditions"

"Design conditions" is a term well known to ventilation engineers. It simply states a certain set of average conditions which will be encountered, some favorable and some unfavorable to the ventilation contemplated. The factors involved include the temperature differential between inside and outside; the stack effect at a given height from intake to outlet; the resistance to the movement of air; the effect of exterior winds; and the number of air changes desired.

Since we are considering only natural draft ventilators of the roof type (in which nature plays an important part) in this article, it is essential to specify the true natural conditions encountered. The weather bureau will give you the average conditions in your community. For example, in the Los Angeles area, there are varying conditions in different sections of the city. Near the ocean, winds averaging 8 to 10 mph prevail, while in the heart of the downtown section, an actual average of 6 mph exists. Then again, in the Burbank area, winds average 7 to 8 mph, while at Pasadena they have diminished to less than 5 mph. All this exists within a radius of less than 15 miles.

You simply cannot have successful gravity ventilation without giving careful attention to the natural conditions which surround you. The accurate weather conditions should be incorporated into the design conditions of the specifications. Furthermore, be sure to ascertain that a negative pressure does not exist in the space in which gravity ventilation is planned. Otherwise natural draft ventilation will not work. The calculations for ventilation problems are not excessive, but the principles must be thoroughly understood.

The selection of roof ventilator equipment is obviously an important part of the problem. What can the owner or his engineer do to assure getting the expected capacities? I believe that the answer is in certified tests of ventilators made by disinterested and reputable laboratories, and there are many such institutions; perhaps the American Society of Heating and Ventilating Engineers could set up a standard test specification regarding sizes and proportions of ventilators to assure uniform comparisons.

The tests, preferably in wind tunnels, should be so conducted that the readings will show averages regardless of wind direction. The latter point is important. Winds have a peculiar habit of shifting from one direction to another—frequently.

The existence of discrepancies between published catalog ratings and those which were certified on the same equipment stresses the importance of certified ratings. Such ratings should, in the author's opinion, be based upon wind directions from 60 deg below horizontal to 90 deg vertical angles.

An Installation Described

Let us consider an actual installation and show how the ventilation computations were made.

The first step was to ascertain the proper design conditions which prevailed in the particular area in which the plant was located. Conservatism was followed throughout the computations, and therefore a 10 F temperature differential between inside and outside temperatures was selected. The net stack effect from the elevation at which the air entered the plant and the roof level showed a difference of 10 ft.

Investigation at the local weather bureau office brought out that the average wind velocity in the plant area was 5.4 mph. We therefore used a 5 mph wind as the basis to compute wind induction capacities. Inasmuch as the roof was flat, with a three-ply felt composition and gravel surface, it was decided to specify six changes of air per hour,

Table I—Air changes per hour with gravity ventilation recommended by the author

	Changes per Hour
Restaurants and Hotel Kitchens	30
Residence Kitchens	20-30
Office and Home (Depending on Density of Occupancy)	6-12
Factories (Where no Process Heating Equipment)	6-12
Night Cooling by Attic Ventilation (Calculate Cubic Contents of Attic and Rooms Below)	6-12
Garages and Repair Shops	4-10
Theaters, Churches, Lodges, Assembly Halls	20-30
Warehouses	2
Small Power Stations and Substations	30
Bakeries	20-30
Laundries	20-30
Stores	6-12
Sheet Metal Buildings	12-15
Farm Barns	
Per Horse	30 cfm
Per Cow	60 cfm

which is an air change every 10 min. No heat generating equipment of any kind was in the space, and fluorescent lighting was used throughout.

The building consists essentially of two rectangles, excluding the toilet areas. One of these rectangles measures 118 ft x 194 ft, and the other one 78 ft x 164 ft, giving a total area of 35,684 sq ft. In order to obtain the cubic content of the building, we multiply this by the height, which is 12.5 ft. Having decided that six changes per hour were desired, the product of the two former numbers was multiplied by six and then divided by 60 (to reduce to minutes) to obtain the cfm, as follows:

$$\frac{35{,}684 \times 12.5 \times 6}{60} = 44{,}605 \text{ cfm}$$

Thus, we find that this building, exclusive of the toilets and restrooms, has a total load of 44,605 cfm. In order to obtain an equal distribution or condition throughout the entire building, ventilators were placed on 20 ft centers longitudinally and 38 ft centers laterally. When we count the number of locations, we find that there are 46 in the factory area. Therefore, in order to ascertain the cfm of air which each ventilator must exhaust, we divide 44,605 by 46, which shows that 969.6 cfm must be exhausted by each ventilator under the specified design conditions.

Referring to the tables published by the manufacturer of the ventilators we are using, we find that a 10 F temperature difference at a 10 ft stack height will exhaust air at a velocity of 108 fpm. We find, from the manufacturer's certified tests, that his ventilator will exhaust air at the rate of 225 fpm velocity, when a 5 mph wind (design) exists.

Next we find, adding these two, that we have 333 fpm velocity for exhausting air under the design conditions. In order to ascertain the net throat area or size of ventilator required, we divide the cfm per ventilator by the velocity: 969.6 ÷ 333 = 2.91 sq ft. This shows that a ventilator with a net throat area of 2.91 sq ft is required to exhaust approximately 970 cfm.

Referring again to the manufacturer's tables, a 22 in. ventilator has a net throat area of 2.64 sq ft, while a 24 in. diameter ventilator has a net throat area of 3.14 sq ft. Inasmuch as the 22 in. ventilator is too small, and the 24 in. is slightly larger than needed, the 24 in. size was recommended for the factory space.

Ventilating the Toilet Rooms

The only spaces that have not been calculated are the two restrooms and toilets. In order to eliminate any possibility of odors traveling from the toilet rooms to the working space, a change of design conditions was made in this instance. It was decided to specify 12 changes of air per hour instead of the six used for the plant proper. By making this change, naturally the size of the ventilators would be increased, and the tendency of air would be to move toward these larger ventilators rather than away from them.

The dimensions of the restrooms and toilets for men and women are 24 ft x 20 ft, with a ceiling height of 12.5 ft. Computing:

$$\frac{2 \times 24' \times 20' \times 12.5' \times 12}{60}$$

$$= 2400 \text{ cfm total load}$$

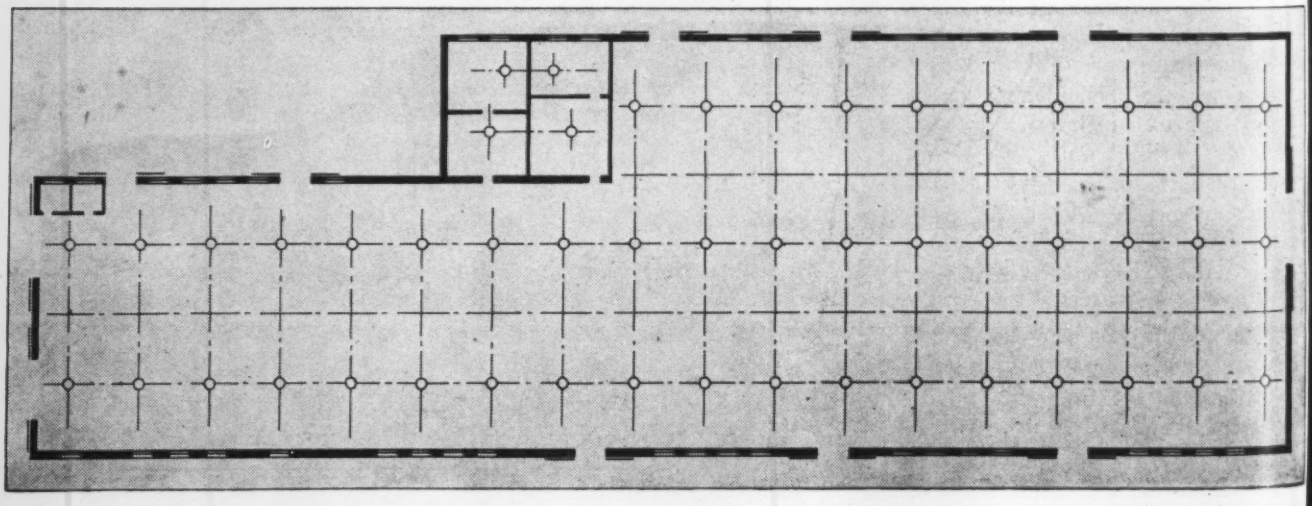
It was decided to place one ventilator on each toilet and each restroom. Therefore, we divide 2400 by four and obtain 600 cfm per ventilator. Dividing 600 by 333 fpm velocity, we find that these ventilators should have a net area of 1.80 sq ft.

Inasmuch as the 18 in. diameter ventilator has a net throat area of 1.77 sq ft, from the manufacturer's literature, and thus is only 0.03 sq ft undersize, this size would have sufficed. However, for uniformity reasons, it was decided to install 24 in. ventilators. The locations are not in the center of the rooms, due to the fact that partitions supporting plumbing fixtures interfere.

After a reasonable length of time for experience had elapsed, a checkback was made on this installation. It was learned that at no time had a high temperature buildup occurred, and no complaints had been received from the employees regarding the functioning of the ventilators.

Scientific calculations based upon heat gain and Btu dissipation are too complicated, and resolve into specifying the number of air changes per hour. From the above simplified method of calculation, good results are only contingent on designating the correct number of air changes per hour. The figures received from the employees regarding the functioning of the ventilators.

The 46 ventilators for the factory area are spotted on 20 ft centers one way and 38 ft centers the other way. In addition, there are four ventilators for the toilet and restroom area.



Comparative ENGINEERING DATA on REFRIGERANTS Given in New TABLES

IN DECIDING which refrigerant to use under a specific set of conditions, tables are needed which give engineering data such as weight and volume of refrigerant to be circulated per ton, and horsepower and capacity. Such tables, in addition to the basic data on thermodynamic properties, are of value in showing at a glance just which refrigerant would be desirable under a given set of circumstances.

For this reason various sets of tables* have been prepared for "Freon"-11, -12, -21, -22, and -113, ammonia, methyl chloride, and water vapor. These tables enable the user to make rapid comparisons of the important basic data needed in deciding whether a refrigerant is suitable for a given set of circumstances. Temperatures are shown in degrees Fahrenheit.

The tables are easy to use. The temperature of the liquid ahead of the expansion valve is equal to the condensing temperature if no subcooling takes place. However, a small amount of subcooling usually takes place in most condensers. It is reasonably safe to figure that the temperature of the liquid ahead of the expansion valve will be about 5 F lower than the actual condensing temperature. The actual condensing temperature corresponding to any given head pressure can, of course, be found in the tables for saturated liquid.

*See HPAC, June 1944, pp. 337-338, July 1944, p. 409, August 1944, pp. 478-480, October 1944; pp. 593-594, May 1945, pp. 256-258, December 1945, pp. 616-618, March 1946, pp. 91-93, and May 1946, pp. 83-85.

"Freon-12"—Theoretical capacity of refrigerating compressors

(Saturated vapor leaving evaporator)

Tons per cu ft per min of vapor compressed

Evap Temp	Temperature of liquid ahead of expansion valve													
	60	65	70	75	80	85	90	95	100	105	110	115	120	125
-20	0.110	0.107	0.105	0.103	0.100	0.0978	0.0953	0.0928	0.0904	0.0879	0.0853	0.0828	0.0802	0.0776
-18	.115	.113	.110	.108	.105	.103	.100	.0975	.0948	.0923	.0896	.0870	.0842	.0817
-16	.121	.118	.116	.113	.110	.108	.105	.102	.0994	.0966	.0941	.0912	.0884	.0858
-14	.126	.124	.121	.118	.115	.113	.110	.107	.104	.101	.0986	.0957	.0928	.0899
-12	.132	.130	.127	.124	.121	.118	.115	.112	.409	.106	.103	.100	.0974	.0943
-10	0.139	0.136	0.133	0.130	0.127	0.124	0.121	0.118	0.115	0.112	0.108	0.105	0.102	0.0989
- 8	.145	.142	.139	.136	.133	.130	.126	.123	.120	.117	.114	.110	.107	.104
- 6	.152	.148	.145	.142	.139	.136	.132	.129	.126	.122	.119	.115	.112	.109
- 4	.158	.155	.152	.149	.145	.142	.138	.135	.132	.128	.124	.121	.117	.114
- 2	.165	.162	.159	.155	.152	.148	.145	.141	.138	.134	.130	.126	.123	.119
0	0.173	0.169	0.166	0.162	0.159	0.155	0.151	0.147	0.144	0.140	0.136	0.132	0.128	0.125
2	.181	.177	.173	.169	.166	.162	.158	.154	.150	.146	.142	.138	.134	.130
4	.189	.185	.181	.177	.173	.169	.165	.161	.157	.153	.149	.145	.140	.136
6	.197	.193	.189	.185	.181	.176	.172	.168	.164	.159	.155	.151	.147	.142
8	.205	.201	.197	.193	.189	.184	.180	.175	.171	.166	.162	.157	.153	.149
10	0.214	0.209	0.205	0.201	0.196	0.192	0.187	0.183	0.178	0.174	0.169	0.164	0.160	0.155
12	.223	.219	.214	.209	.205	.200	.196	.190	.186	.181	.177	.172	.167	.162
14	.233	.228	.223	.218	.213	.209	.204	.199	.194	.189	.184	.179	.174	.169
16	.242	.238	.233	.228	.223	.218	.213	.207	.202	.197	.192	.187	.182	.177
18	.252	.248	.242	.237	.233	.227	.222	.216	.211	.206	.200	.195	.190	.184
20	0.263	0.257	0.253	0.247	0.242	0.236	0.231	0.225	0.220	0.214	0.209	0.203	0.198	0.192
22	.274	.268	.262	.257	.252	.246	.241	.235	.229	.223	.218	.212	.206	.200
24	.285	.279	.273	.268	.262	.256	.251	.244	.239	.233	.227	.220	.215	.208
26	.296	.290	.285	.279	.272	.266	.260	.254	.248	.242	.236	.229	.224	.217
28	.308	.301	.295	.289	.283	.277	.270	.264	.258	.252	.245	.239	.233	.226
30	0.319	0.313	0.307	0.301	0.295	0.288	0.282	0.275	0.269	0.262	0.255	0.249	0.242	0.235
32	.332	.325	.319	.313	.306	.299	.293	.286	.279	.272	.265	.258	.251	.244
34	.345	.338	.331	.324	.317	.311	.304	.297	.290	.282	.276	.269	.262	.254
36	.358	.351	.344	.337	.330	.323	.316	.309	.301	.294	.287	.279	.272	.265
38	.372	.365	.358	.350	.342	.336	.328	.321	.313	.306	.298	.291	.282	.275
40	0.386	0.379	0.372	0.364	0.357	0.348	0.341	0.332	0.326	0.316	0.310	0.302	0.293	0.286
42	.400	.392	.385	.377	.369	.361	.353	.345	.338	.329	.322	.313	.305	.297
44	.415	.407	.398	.391	.383	.375	.368	.358	.350	.341	.333	.325	.316	.308
46	.429	.422	.415	.405	.398	.389	.380	.372	.364	.355	.346	.337	.329	.319
48	.446	.439	.429	.420	.412	.403	.395	.385	.377	.368	.358	.350	.341	.331
50	0.463	0.455	0.444	0.437	0.427	0.418	0.410	0.400	0.391	0.382	0.372	0.362	0.353	0.344
52	.478	.469	.461	.452	.442	.433	.424	.413	.405	.395	.386	.376	.366	.357
54	.495	.485	.476	.467	.459	.448	.439	.429	.420	.410	.400	.389	.380	.369
56	.513	.503	.493	.483	.474	.465	.455	.444	.435	.426	.415	.405	.394	.383
58	.532	.521	.513	.500	.493	.481	.472	.461	.450	.441	.429	.418	.408	.397

"Freon-12"—Volume of refrigerant to be compressed

(Saturated vapor leaving evaporator)

Cu ft per min per ton of refrigerating capacity

Evap Temp	Temperature of liquid ahead of expansion valve													
	60	65	70	75	80	85	90	95	100	105	110	115	120	125
-20	9.10	9.32	9.52	9.75	9.97	10.2	10.5	10.8	11.1	11.4	11.7	12.1	12.5	12.9
-18	8.70	8.88	9.08	9.29	9.50	9.74	10.0	10.3	10.6	10.8	11.2	11.5	11.9	12.2
-16	8.29	8.48	8.65	8.86	9.08	9.29	9.54	9.79	10.1	10.4	10.6	11.0	11.3	11.7
-14	7.92	8.09	8.27	8.46	8.66	8.86	9.10	9.34	9.58	9.86	10.1	10.4	10.8	11.1
-12	7.56	7.72	7.89	8.07	8.27	8.46	8.69	8.91	9.15	9.41	9.67	9.96	10.3	10.6
-10	7.21	7.38	7.53	7.71	7.89	8.08	8.29	8.50	8.73	8.96	9.23	9.50	9.79	10.1
- 8	6.90	7.05	7.21	7.36	7.53	7.72	7.92	8.12	8.34	8.56	8.80	9.07	9.34	9.64
- 6	6.59	6.74	6.88	7.04	7.20	7.38	7.56	7.75	7.95	8.19	8.41	8.67	8.93	9.21
- 4	6.31	6.44	6.57	6.73	6.89	7.06	7.23	7.41	7.60	7.82	8.04	8.27	8.52	8.80
- 2	6.05	6.16	6.30	6.44	6.59	6.75	6.91	7.09	7.27	7.47	7.68	7.91	8.14	8.40
0	5.78	5.91	6.02	6.17	6.30	6.45	6.61	6.78	6.96	7.15	7.35	7.56	7.79	8.02
2	5.54	5.65	5.78	5.90	6.03	6.18	6.33	6.49	6.66	6.84	7.04	7.23	7.45	7.68
4	5.30	5.42	5.53	5.66	5.78	5.92	6.06	6.21	6.37	6.55	6.72	6.92	7.12	7.35
6	5.08	5.19	5.30	5.41	5.54	5.67	5.80	5.96	6.10	6.27	6.44	6.63	6.82	7.03
8	4.87	4.97	5.08	5.19	5.30	5.43	5.57	5.71	5.85	6.01	6.17	6.35	6.52	6.73
10	4.67	4.78	4.88	4.98	5.09	5.21	5.34	5.47	5.61	5.76	5.92	6.08	6.26	6.44
12	4.49	4.57	4.67	4.78	4.88	5.00	5.11	5.25	5.37	5.52	5.66	5.82	6.00	6.17
14	4.30	4.39	4.49	4.58	4.69	4.79	4.90	5.03	5.15	5.29	5.43	5.58	5.74	5.91
16	4.13	4.21	4.30	4.39	4.49	4.59	4.70	4.82	4.94	5.07	5.20	5.35	5.50	5.66
18	3.97	4.04	4.13	4.22	4.30	4.41	4.51	4.62	4.73	4.86	4.99	5.12	5.27	5.43
20	3.80	3.89	3.96	4.05	4.14	4.23	4.33	4.44	4.54	4.67	4.79	4.92	5.06	5.21
22	3.65	3.73	3.81	3.89	3.97	4.06	4.15	4.26	4.37	4.48	4.59	4.72	4.85	5.00
24	3.51	3.59	3.66	3.73	3.82	3.90	3.99	4.09	4.19	4.30	4.41	4.54	4.66	4.80
26	3.38	3.45	3.51	3.59	3.67	3.76	3.84	3.93	4.03	4.13	4.24	4.36	4.47	4.60
28	3.25	3.32	3.39	3.46	3.53	3.61	3.70	3.79	3.87	3.97	4.08	4.19	4.30	4.43
30	3.13	3.19	3.26	3.32	3.39	3.47	3.55	3.64	3.72	3.81	3.92	4.02	4.13	4.25
32	3.01	3.08	3.13	3.20	3.27	3.34	3.41	3.50	3.59	3.68	3.77	3.87	3.98	4.09
34	2.90	2.96	3.02	3.09	3.15	3.22	3.29	3.37	3.45	3.54	3.62	3.72	3.82	3.94
36	2.79	2.85	2.91	2.97	3.03	3.10	3.16	3.24	3.32	3.40	3.49	3.58	3.68	3.78
38	2.69	2.74	2.79	2.86	2.92	2.98	3.05	3.12	3.19	3.27	3.36	3.44	3.54	3.63
40	2.59	2.64	2.69	2.75	2.80	2.87	2.93	3.01	3.07	3.16	3.23	3.31	3.41	3.50
42	2.50	2.55	2.60	2.65	2.71	2.77	2.83	2.90	2.96	3.04	3.11	3.20	3.28	3.37
44	2.41	2.46	2.51	2.56	2.61	2.67	2.72	2.79	2.86	2.93	3.00	3.08	3.16	3.25
46	2.33	2.37	2.41	2.47	2.51	2.57	2.63	2.69	2.75	2.82	2.89	2.97	3.04	3.13
48	2.24	2.28	2.33	2.38	2.43	2.48	2.53	2.60	2.65	2.72	2.79	2.86	2.93	3.02
50	2.16	2.20	2.25	2.29	2.34	2.39	2.44	2.50	2.56	2.62	2.69	2.76	2.83	2.91
52	2.09	2.13	2.17	2.21	2.26	2.31	2.36	2.42	2.47	2.53	2.59	2.66	2.73	2.80
54	2.02	2.06	2.10	2.14	2.18	2.23	2.28	2.33	2.38	2.44	2.50	2.57	2.63	2.71
56	1.95	1.99	2.03	2.07	2.11	2.15	2.20	2.25	2.30	2.35	2.41	2.47	2.54	2.61
58	1.88	1.92	1.95	2.00	2.03	2.08	2.12	2.17	2.22	2.27	2.33	2.39	2.45	2.52

"Freon-12"—Weight of refrigerant to be circulated

(Saturated vapor leaving evaporator)

Lb per min per ton of refrigerating capacity

Evap Temp	Temperature of liquid ahead of expansion valve													
	65	65	70	75	80	85	90	95	100	105	110	115	120	125
-20	3.68	3.77	3.85	3.94	4.03	4.13	4.24	4.36	4.47	4.60	4.74	4.88	5.04	5.21
-18	3.67	3.75	3.83	3.92	4.01	4.11	4.22	4.33	4.45	4.58	4.71	4.85	5.01	5.17
-16	3.65	3.73	3.81	3.90	4.00	4.09	4.20	4.31	4.43	4.56	4.68	4.83	4.98	5.14
-14	3.64	3.72	3.80	3.89	3.98	4.07	4.18	4.29	4.40	4.53	4.66	4.80	4.95	5.11
-12	3.62	3.70	3.78	3.87	3.96	4.05	4.16	4.27	4.38	4.51	4.63	4.77	4.92	5.08
-10	3.60	3.69	3.76	3.85	3.94	4.04	4.14	4.25	4.36	4.48	4.61	4.75	4.89	5.05
- 8	3.59	3.67	3.75	3.83	3.92	4.02	4.12	4.23	4.34	4.46	4.58	4.72	4.86	5.02
- 6	3.57	3.65	3.73	3.82	3.90	4.00	4.10	4.20	4.31	4.44	4.56	4.70	4.84	4.99
- 4	3.56	3.64	3.71	3.80	3.89	3.98	4.08	4.18	4.29	4.41	4.54	4.67	4.81	4.97
- 2	3.55	3.62	3.70	3.78	3.87	3.96	4.06	4.16	4.27	4.39	4.51	4.65	4.78	4.93
0	3.53	3.61	3.68	3.77	3.85	3.94	4.04	4.14	4.25	4.37	4.49	4.62	4.76	4.90
2	3.52	3.59	3.67	3.75	3.83	3.93	4.02	4.12	4.23	4.35	4.47	4.60	4.73	4.88
4	3.50	3.58	3.65	3.74	3.82	3.91	4.00	4.10	4.21	4.33	4.44	4.57	4.70	4.85
6	3.49	3.56	3.64	3.72	3.80	3.89	3.98	4.09	4.19	4.30	4.42	4.55	4.68	4.82
8	3.47	3.55	3.62	3.70	3.78	3.87	3.97	4.07	4.17	4.28	4.40	4.53	4.65	4.80
10	3.46	3.54	3.61	3.69	3.77	3.86	3.95	4.05	4.15	4.26	4.38	4.50	4.63	4.77
12	3.45	3.52	3.59	3.67	3.75	3.84	3.93	4.03	4.13	4.24	4.35	4.48	4.61	4.74
14	3.43	3.51	3.58	3.66	3.74	3.82	3.91	4.01	4.11	4.22	4.33	4.46	4.58	4.72
16	3.42	3.49	3.56	3.64	3.72	3.81	3.89	3.99	4.09	4.20	4.31	4.43	4.56	4.69
18	3.41	3.48	3.55	3.63	3.70	3.79	3.88	3.97	4.07	4.18	4.29	4.41	4.53	4.67
20	3.39	3.47	3.53	3.61	3.69	3.78	3.86	3.96	4.05	4.16	4.27	4.39	4.51	4.65
22	3.38	3.45	3.52	3.60	3.67	3.76	3.84	3.94	4.04	4.14	4.25	4.37	4.49	4.62
24	3.37	3.44	3.51	3.58	3.66	3.74	3.83	3.92	4.02	4.12	4.23	4.35	4.47	4.60
26	3.36	3.43	3.49	3.57	3.64	3.73	3.81	3.90	4.00	4.10	4.21	4.33	4.44	4.57
28	3.34	3.41	3.48	3.56	3.63	3.71	3.80	3.89	3.98	4.08	4.19	4.31	4.42	4.55
30	3.33	3.40	3.47	3.54	3.61	3.70	3.78	3.87	3.96	4.06	4.17	4.28	4.40	4.53
32	3.32	3.39	3.45	3.53	3.60	3.68	3.76	3.86	3.95	4.05	4.15	4.26	4.38	4.51
34	3.31	3.37	3.44	3.52	3.59	3.67	3.75	3.84	3.93	4.03	4.13	4.24	4.36	4.49
36	3.29	3.36	3.43	3.50	3.57	3.65	3.73	3.82	3.91	4.01	4.11	4.22	4.34	4.46
38	3.28	3.35	3.41	3.49	3.56	3.64	3.72	3.81	3.90	3.99	4.10	4.20	4.32	4.44
40	3.27	3.34	3.40	3.47	3.54	3.63	3.70	3.79	3.88	3.98	4.08	4.19	4.30	4.42
42	3.26	3.32	3.39	3.46	3.53	3.61	3.69	3.78	3.86	3.96	4.06	4.17	4.28	4.40
44	3.25	3.31	3.38	3.45	3.52	3.60	3.67	3.76	3.85	3.94	4.04	4.15	4.26	4.38
46	3.24	3.30	3.36	3.44	3.50	3.58	3.66	3.75	3.83	3.93	4.02	4.13	4.24	4.36
48	3.23	3.29	3.35	3.42	3.49	3.57	3.64	3.73	3.82	3.91	4.01	4.11	4.22	4.34
50	3.21	3.28	3.34	3.41	3.48	3.56	3.63	3.72	3.80	3.89	3.99	4.09	4.20	4.32
52	3.20	3.27	3.33	3.40	3.47	3.54	3.62	3.70	3.79	3.88	3.97	4.08	4.18	4.30
54	3.19	3.26	3.32	3.39	3.45	3.53	3.60	3.69	3.77	3.86	3.96	4.06	4.16	4.28
56	3.18	3.24	3.31	3.37	3.44	3.52	3.59	3.67	3.76	3.85	3.94	4.04	4.15	4.26
58	3.17	3.23	3.29	3.36	3.43	3.50	3.58	3.66	3.74	3.83	3.92	4.02	4.13	4.24

"Freon-12"—Theoretical horsepower per cu ft per min of vapor compressed

Evap Temp	Condensing temperature 60	65	70	75	80	85	90	95	100	105	110	115	120	125
-20	0.112	0.119	0.125	0.131	0.137	0.142	0.148	0.154	0.159	0.165	0.170	0.175	0.180	0.185
-18	.114	.120	.126	.133	.139	.145	.151	.157	.162	.168	.174	.179	.184	.189
-16	.115	.122	.128	.135	.141	.148	.154	.160	.166	.172	.177	.183	.188	.194
-14	.116	.123	.130	.137	.144	.150	.157	.163	.169	.176	.181	.187	.193	.198
-12	.118	.125	.132	.139	.146	.153	.160	.166	.173	.179	.185	.191	.197	.203
-10	0.119	0.126	0.134	0.141	0.148	0.155	0.162	0.169	0.176	0.183	0.189	0.195	0.201	0.207
- 8	.120	.127	.135	.143	.150	.157	.165	.172	.179	.186	.193	.199	.206	.212
- 6	.120	.128	.137	.144	.152	.160	.167	.175	.182	.190	.196	.203	.210	.216
- 4	.121	.129	.138	.146	.154	.162	.170	.178	.186	.193	.200	.207	.214	.221
- 2	.122	.130	.139	.148	.156	.164	.173	.181	.188	.196	.204	.211	.218	.225
0	0.122	0.131	0.140	0.149	0.158	0.166	0.175	0.183	0.192	0.200	0.207	0.215	0.222	0.229
2	.122	.131	.141	.150	.159	.168	.177	.186	.194	.203	.211	.219	.226	.234
4	.122	.132	.142	.151	.161	.170	.179	.188	.197	.206	.214	.222	.230	.238
6	.122	.132	.142	.152	.162	.171	.181	.191	.200	.209	.217	.226	.234	.242
8	.121	.132	.143	.153	.163	.173	.183	.193	.202	.211	.220	.229	.238	.246
10	0.121	0.132	0.143	0.153	0.163	0.174	0.184	0.195	0.204	0.214	0.223	0.232	0.241	0.250
12	.120	.131	.143	.154	.164	.175	.186	.197	.207	.217	.226	.236	.245	.254
14	.119	.130	.142	.154	.165	.176	.187	.198	.209	.219	.229	.239	.248	.258
16	.118	.130	.142	.154	.165	.177	.188	.200	.211	.222	.232	.242	.252	.261
18	.116	.129	.141	.154	.165	.177	.189	.201	.213	.224	.235	.245	.255	.265
20	0.114	0.127	0.141	0.153	0.165	0.178	0.191	0.203	0.214	0.226	0.237	0.248	0.259	0.269
22	.112	.126	.139	.153	.165	.178	.191	.204	.216	.228	.240	.251	.262	.273
24	.110	.124	.138	.152	.164	.178	.192	.205	.217	.230	.242	.253	.265	.276
26	.107	.121	.136	.150	.163	.178	.192	.205	.218	.231	.243	.256	.267	.279
28	.104	.119	.134	.148	.162	.177	.191	.205	.219	.232	.245	.257	.269	.282
30	0.100	0.116	0.131	0.147	0.161	0.176	0.191	0.205	0.219	0.233	0.246	0.259	0.272	0.284
32	.0966	.113	.129	.144	.159	.175	.190	.205	.219	.234	.247	.261	.273	.286
34	.0924	.109	.126	.142	.157	.173	.189	.205	.219	.234	.248	.262	.275	.289
36	.0879	.105	.122	.139	.155	.171	.188	.204	.219	.235	.249	.263	.277	.291
38	.0829	.101	.118	.136	.152	.169	.186	.203	.219	.235	.250	.264	.278	.293
40	0.0776	0.0957	0.114	0.132	0.149	0.167	0.184	0.202	0.218	0.235	0.250	0.265	0.280	0.294
42	.0719	.0905	.109	.128	.146	.164	.182	.200	.217	.234	.250	.265	.280	.295
44	.0657	.0851	.104	.124	.142	.161	.179	.198	.215	.233	.249	.265	.281	.297
46	.0590	.0789	.0992	.119	.138	.157	.177	.195	.213	.232	.249	.265	.281	.297
48	.0521	.0727	.0936	.114	.134	.154	.173	.193	.211	.230	.248	.265	.282	.298
50	0.0448	0.0663	0.0877	0.109	0.129	0.150	0.170	0.190	0.209	0.229	0.247	0.264	0.282	0.299
52	.0371	.0590	.0812	.103	.124	.145	.166	.187	.207	.227	.245	.264	.281	.299
54	.0285	.0512	.0740	.0966	.118	.140	.162	.183	.204	.224	.244	.262	.281	.299
56	.0195	.0429	.0664	.0897	.112	.134	.157	.179	.200	.222	.241	.260	.279	.298
58			.0582	.0823	.105	.129	.152	.174	.196	.218	.238	.259	.278	.298

"Freon-12"—Theoretical horsepower of refrigerating compressors

(Saturated vapor entering compressor)

Horsepower per ton

Evap Temp	Condensing temperature 60	65	70	75	80	85	90	95	100	105	110	115	120	125
-20	1.02	1.11	1.19	1.27	1.36	1.45	1.55	1.66	1.76	1.88	1.99	2.11	2.24	2.38
-18	0.989	1.07	1.15	1.23	1.32	1.41	1.51	1.61	1.71	1.83	1.94	2.06	2.18	2.32
-16	0.955	1.03	1.11	1.20	1.28	1.37	1.47	1.57	1.67	1.78	1.89	2.01	2.13	2.26
-14	0.923	1.00	1.08	1.16	1.24	1.33	1.43	1.52	1.62	1.73	1.84	1.95	2.08	2.21
-12	0.889	0.965	1.04	1.12	1.21	1.29	1.39	1.48	1.58	1.69	1.79	1.90	2.02	2.15
-10	0.856	0.933	1.01	1.09	1.17	1.25	1.34	1.44	1.54	1.64	1.74	1.86	1.97	2.10
- 8	.825	.898	0.974	1.05	1.13	1.22	1.31	1.40	1.49	1.60	1.70	1.81	1.92	2.04
- 6	.793	.867	0.940	1.02	1.10	1.18	1.27	1.36	1.45	1.55	1.65	1.76	1.87	1.99
- 4	.764	.835	0.907	0.985	1.06	1.14	1.23	1.32	1.41	1.51	1.61	1.71	1.82	1.94
- 2	.735	.804	0.877	0.951	1.03	1.11	1.19	1.28	1.37	1.47	1.56	1.67	1.78	1.89
0	0.705	0.774	0.844	0.920	0.994	1.07	1.16	1.24	1.33	1.43	1.52	1.62	1.73	1.84
2	.677	.743	.814	.887	.960	1.04	1.12	1.21	1.29	1.39	1.48	1.58	1.68	1.79
4	.648	.715	.783	.857	.929	1.01	1.08	1.17	1.26	1.35	1.44	1.54	1.64	1.75
6	.620	.685	.755	.825	.895	0.971	1.05	1.14	1.22	1.31	1.40	1.50	1.60	1.70
8	.591	.657	.724	.793	.863	0.937	1.02	1.10	1.18	1.27	1.36	1.46	1.55	1.66
10	0.564	0.629	0.695	0.764	0.832	0.906	0.984	1.07	1.15	1.23	1.32	1.41	1.51	1.61
12	.538	.601	.666	.734	.801	.874	.950	1.03	1.11	1.20	1.28	1.37	1.47	1.57
14	.510	.574	.638	.705	.772	.842	.917	0.996	1.07	1.16	1.24	1.34	1.42	1.52
16	.485	.546	.609	.676	.741	.812	.884	0.963	1.04	1.12	1.21	1.29	1.38	1.48
18	.460	.520	.583	.649	.711	.782	.855	0.930	1.01	1.09	1.17	1.26	1.34	1.44
20	0.435	0.496	0.556	0.621	0.684	0.754	0.824	0.901	0.974	1.05	1.14	1.22	1.31	1.40
22	.411	.470	.530	.594	.655	.724	.794	.869	.944	1.02	1.10	1.19	1.27	1.36
24	.386	.444	.504	.566	.628	.695	.765	.837	.911	0.987	1.07	1.15	1.23	1.32
26	.362	.419	.478	.540	.599	.667	.735	.806	.879	0.955	1.03	1.11	1.19	1.28
28	.337	.393	.452	.514	.573	.637	.707	.777	.846	0.921	0.998	1.08	1.16	1.25
30	0.313	0.369	0.428	0.487	0.545	0.610	0.677	0.746	0.815	0.889	0.964	1.04	1.12	1.21
32	.291	.346	.403	.462	.519	.583	.648	.718	.786	.860	.932	1.01	1.09	1.17
34	.268	.322	.379	.438	.494	.557	.622	.689	.756	.829	.900	0.975	1.05	1.14
36	.245	.299	.355	.412	.468	.530	.594	.660	.726	.798	.868	0.942	1.02	1.10
38	.223	.276	.330	.388	.444	.505	.568	.633	.698	.767	.838	0.910	0.985	1.06
40	0.201	0.253	0.307	0.363	0.418	0.479	0.540	0.605	0.669	0.739	0.807	0.880	0.952	1.03
42	.180	.230	.284	.340	.395	.454	.515	.579	.641	.710	.777	.848	.920	0.997
44	.158	.209	.262	.316	.371	.429	.488	.551	.614	.680	.747	.817	.887	0.963
46	.137	.187	.239	.294	.346	.404	.464	.526	.586	.654	.718	.787	.856	0.931
48	.117	.166	.218	.271	.324	.381	.439	.500	.562	.626	.691	.757	.826	0.900
50	0.0969	0.146	0.197	0.250	0.302	0.358	0.416	0.476	0.535	0.599	0.663	0.728	0.796	0.870
52	.0774	.126	.176	.228	.281	.335	.392	.451	.511	.574	.635	.701	.767	.838
54	.0575	.106	.155	.207	.258	.312	.368	.427	.485	.547	.609	.673	.738	.808
56	.0379	.0851	.135	.185	.236	.290	.345	.402	.461	.522	.582	.644	.710	.778
58			.114	.164	.214	.267	.322	.378	.435	.496	.554	.617	.681	.748

"It is intelligent ventilating practice to corral the heat or odors as close as practical to their source."

Practical Pointers on KITCHEN VENTILATION

THE reasons for ventilating kitchens are principally to remove excess heat and to prevent escape into the building of unpleasant odors. Despite well insulated heat sources, kitchens often are too warm for the comfort of the employees. Range and bake ovens do get warm. Some foods are boiled, and dishes have to be washed and scalded, so that steam enters the air and induces high relative humidity.

The high relative humidity influences comfort very materially, since air that is already nearly saturated with moisture cannot evaporate perspiration from the skin, and such evaporation of water from the body is nature's most important means for cooling the too warm people in a kitchen.

Bilge Water Aroma

Some public kitchens have a bilge water aroma unmistakable to the initiated, and certainly unpleasant and definitely not desirable for dissemination into the dining room. If the clean odor of baking pastry, broiling beefsteak—even that of cooking onions—could be filtered out from the sour, depressing odor of partly clogged floor drains, cockroach havens, rotting vegetables, rat's nests and the like, perhaps we would appreciate better the advertising value of a kitchen.

We can install fans and ducts and can to some extent discourage kitchen smells from leaking out of kitchens, but the fans may not always operate, and even if they do operate they cannot replace good housekeeping and thorough cleaning. The good housekeeping and thorough cleaning are of course aided greatly if there are no dark, inaccessible corners, and if the kitchen equipment is cleanable.

One sees a modern surgical operation in a hospital. The surgeons and nurses all wear mouth and nose masks. Often in warm weather a special nurse continually swabs the perspiration from the surgeon's face, so that risk of contamination may be reduced. Certain bodily fluids are said to be not only sterile but also antiseptic. Such claims are not made for perspiration. Thus we design elaborate ventilating and cooling systems for hospital operating rooms, among other reasons, to reduce danger of wound contamination by dripping perspiration.

Anyone who ever visited a bus public kitchen has observed th very heavy perspiration on th bodies of the employees due to th high relative humidity and intens radiant heat.

It is observed that a man will en dure air movement toward his fac at speeds and temperatures tha when coming toward his back wi "frighten" him if not actually caus illness. A person working over a hot stove, above which there is th conventional canopy, usually mus face the stove. The air to replac that removed through the canop then would travel against the bac of the person and if this air spee is too rapid or too much cooler tha the person's body, he will be un comfortable and may go to bed wit lame back and neck muscles. H may even acquire a common cold.

Replacement Air

It is intelligent ventilating pra tice to corral the heat or odors

close as practical to their source. This suggests therefore, that air exhaust outlets from kitchens should be close to ranges, ovens, steam tables, dishwashers, and the like. There must be removed from the apparatuses a considerable volume of air. This air must be replaced with normally comfortable air that originally must have come from outdoors. If no provisions are made for conditioning the temperature of this replacement air, acceptable kitchen conditions can be expected only during those parts of the day and during those relatively few days of the year when the outside air is slightly cooler than the air temperature desired in the kitchen. If the outside air is warmer than the air temperature desired in the kitchen, the kitchen assuredly will become still warmer, no matter how much power is expended in pumping air through the kitchen.

If no provision is made for removing, from the replacement air, the cinders and soot, bird feathers, and other debris prevalent in the air of cities, the appearance of such debris can be expected in the food.

Research has not established how many of the unexplained epidemics are due to sweat in the food deposited there inadvertently by the too-warm cook, but there are possibilities of this being a cause of them.

For many of these reasons, mechanical ventilation of public kitchens is a legal requirement in many cities. The Chicago ventilation code, for example, requires that there shall be removed from such rooms not less than 4 cfm of air per sq ft of floor area in the room. If there are windows capable of admitting outside air into the kitchen with openings through them of area equal to 3 per cent of the floor area, the Chicago law says these may suffice. If the openable area of the windows in the outside wall is less than 3 per cent of the floor area, then a mechanically delivered air supply must be provided and this must furnish at least 1.2 cfm of air per sq ft of floor area in the kitchen. Presumably the 2.8 cfm needed to replace the 4 cfm removed by the exhaust fans must leak into the kitchen from some adjacent room.

In most cases the dining room is adjacent to the kitchen and the air supply to replace that removed from the kitchen enters the latter from the dining room.

In many cases there are very objectionable drafts around the unfortunate occupants of the dining rooms who must sit near the doors leading to the kitchens.

"People Are Combustion Apparatuses"

I think of the ventilation in the kitchen in an existing large hotel. The dining rooms are completely air conditioned; that is, they receive refrigerated air in summer and warmed air in winter, in sufficient volume from outdoors to control the cooling without drafts. Few people consider that the problem of promoting human comfort is a year 'round cooling proposition. People operate as very efficient low temperature combustion apparatuses, and a healthy person always gives off heat. His personal temperature is regulated by nature on the principle of increasing or reducing the rate of this heat donation. We attempt to promote comfort by creating artificially, inside rooms, such air conditions as will make it easier for nature to get rid of the heat from the bodies.

Part of the air from the dining rooms in this hotel is recirculated back to the air supply system, as a measure of economy in fuel in winter and in refrigeration in summer. It is desirable to replace about one-third of the air supply by taking this much of it directly from outdoors, so that the odors of tobacco and humans may be diluted and rendered unnoticeable. This third of the air must be removed from the dining rooms or we could not find space for the new outside air.

With high relative humidity such as may be present in summer in normal outside air, the sense of smell is accentuated. Most of the one-third component in the air moved through the dining rooms is therefore available on the way out, for the function of alleviating conditions in the kitchen. Distributed exhaust outlets from the dining room, placed overhead so as to insure a gentle air movement around the diners, are connected to a fan which can discharge this air through overhead ducts in the kitchen. This fan may receive air supply directly from out of doors in any desired proportion and this outside air is warmed and filtered.

Distributing Ducts in Kitchen

The distrbiuting ducts in the kitchen deliver the air at about 70 deg in winter and 80 deg in summer to the various departments. For the cooking range the diffusers for the entering air are directly above the work area, and while the air velocity may be adjusted at will by the cooks, the designed maximum air speed about their bodies at the canopy edges is about 150 linear fpm, and at the rate of about 8 cfm per sq ft of floor in that zone.

For the bake oven area the air enters through grilles in the floor at the same design speed. For the dishwashing areas the air supply is overhead with horizontally discharging diffusing grilles having both horizontal and vertical movable vanes.

There is a seperate exhaust fan for each major department—the range, the dishwashing machine, the general work areas—since a

IN THIS regular feature, informal comment on heating, piping, and air conditioning matters is given by Samuel R. Lewis, consulting mechanical engineer, a member of HPAC's board of consulting and contributing editors. This month he gives some practical pointers on ventilating large kitchens, with suggestions based on actual experience with a number of big building installations.

single exhaust fan, perhaps in some distant location, cannot serve these various functions with their different resistances to air flow.

Preventing Grease Fires

The range hood inevitably becomes grease loaded and may catch fire. Therefore, the exhaust ducts from it are of heavy gage steel, arranged to take no serious damage even if they should become red hot and all combustible structural material of the building is fireproofed against this contingency. There is a bypass around the range hood exhaust fan with a photo-electric cell to control the bypass damper, so that in case of fire the damper opens to prevent warping the fan. The electrical connections from the cell also cause the fan motor to stop, and also cease to prevent the ringing of an alarm which otherwise would give notice of trouble even if the electric energy to the equipment were cut off.

The exhaust fans of all the departments in the kitchen are of the centrifugal type, definitely capable of overcoming considerable resistance to air flow, and their outlets into the air are above the roof and open upward so that regardless of wind direction, the air volume delivered will be constant. The conventional disk type exhaust fan placed in the outside wall of a restaurant kitchen cannot overcome any serious resistance. Its output varies with the wind pressure against which it frequently must discharge, and if it does not happen to be running, outside air backs in through such a fan. Even if we have a well designed exhaust fan and if its outlet must face the wind, as through a wall or as through the conventional gooseneck above the roof, there will be very wide variations in the air volume handled.

It is not difficult to arrange exhaust fan outlets so that they blow vertically, and so that rain and snow cannot enter the kitchen. In one interesting case in a large metropolitan hotel, there was complaint of a tendency on certain days for some of the kitchen employees to pass out from overheating. The exhaust fans were running and the management confessed inability to understand this intermittent difficulty. After we changed the exhaust fan outlets so that they were no longer nullified by wind pressure against their horizontally-looking outlets, the trouble ended.

The ventilation of a kitchen otherwise well designed in the top story of a metropolitan clubhouse was deficient, and the effluvia of onions and turnips was objectionable in the dining room because this kitchen had many windows. The windows could not be kept closed. A strong wind would deliver so much delightful outside air through the windows that the exhaust fans working on the various hoods could not prevent copious air delivery from the kitchen into the dining room. The crafty designer therefore likes to have plenty of windows in dining rooms, but has no windows in the public kitchen.

Few kitchens are given sufficient food storage rooms, and these storage rooms, especially for raw vegetables, often are not ventilated. When I was a boy on a farm we stored the potatoes, beets, turnips, cabbages, and sauerkraut in the cellar where they would not freeze. I remember how they smelled!

Pipe Line for Liquid Carbon Dioxide Eliminates Handling, Shipping Problems

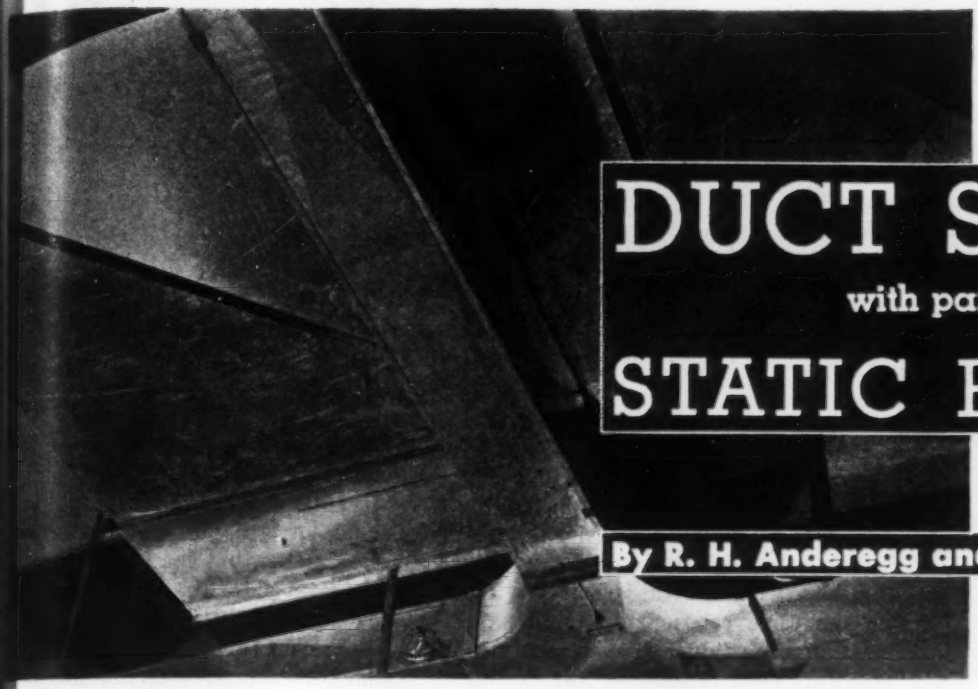
THE "WORLD'S most unusual" pipe line, which carries a normally gaseous material—carbon dioxide—in a refrigerated pressurized form directly from producer to consumer, thus inaugurating a revolutionary change in supply procedure for this product, has been announced by Walter Kidde & Co., Inc., Belleville, N. J., manufacturers of fire protection equipment and largest consuming customer of the Liquid Carbonic Corp.'s new plant.

CO_2 formerly delivered by truck or rail is now handled efficiently by piping

The carbon dioxide was previously delivered by truck or rail in the form of dry ice, or in the form of gas in heavy and bulky pressure tanks; it is now pumped as a liquid under pressure from the plant of the producer into storage tanks in the Kidde plant. The pipe line runs more than a quarter of a mile from plant to plant. Although largely underground to benefit from normal insulation characteristics of the earth, approximately 200 ft of pipe has been placed above the ground at the delivery end.

The pipe is standard 2 in. steel with welded joints. In order to keep carbon dioxide at a low temperature and to prevent condensation on outside of pipe, it is insulated with asphalt paint and two layers of roofing (tar) paper in addition to the natural ground insulation. One section of the line that runs under a railroad siding was installed by inserting it through a 14 in. steel pipe that had previously served as a steam main. This section, as well as the 200 ft overhead section, have been additionally insulated with 8 in. of cork.

The pipe line will furnish carbon dioxide more efficiently than before by eliminating handling and shipping problems. Constant pressure will keep a supply of this product always on tap so that the storage tanks, from which fire extinguishers are filled, can be kept at capacity.



DUCT SIZING with partial STATIC REGAIN

By R. H. Anderegg and F. W. Hutchinson

AN IDEAL application of the principle of static regain in duct design would allow the duct cross section to increase so gradually that the reduction in velocity—and accompanying loss of velocity pressure—would occur reversibly and hence would permit 100 per cent conversion to static pressure. Such a design is impracticable for a number of reasons.

In the first place, the economics of duct construction are such that a continuously increasing cross section would be prohibitively expensive; any practical application of the principle must therefore utilize duct lengths of fixed cross section, the area changing only at fixed points and preferably at points along the length at which some special construction (as, for example, a take-off) is in any event required.

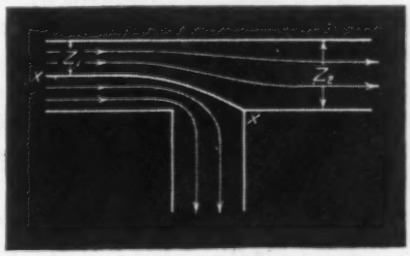
Turbulent Losses

Second, a study of the hydrodynamics of an expanding air stream will show that completely reversible expansion is not possible and that the turbulent losses associated with velocity reductions in transition sections of ordinary size and construction are of the order of 40 to 60 per cent. The turbulent loss increases with the ratio of initial to final velocity and increases also with the angle which the side walls of the transition section make with the axis of the duct. For a velocity ratio of 5 and an angle of 40 deg, the turbulent loss accounts for approximately 50 per cent of the kinetic energy made available by the drop in velocity; an abrupt expansion at the same velocity ratio would account for a 65 per cent turbulent loss, whereas expansion through an angle of only 7 deg would reduce the loss to less than 10 per cent.

Simple Expanding Section Seldom Found in Practice

In practice, however, a simple expanding transition section is seldom found, the actual expansion usually occurring either in a duct of constant cross section as a result of reduced carry-through volume after a branch take-off, or in a complex fitting designed to provide gradual expansion of the straight-through air stream simultaneously with bleeding of air to a branch duct. Fig. 1 illustrates the type of flow that would be expected through a fitting of this type; the stream lines identify two distinct regions of flow, the one representing fluid which exits through the take-off whereas the other stream of fluid acts as though it were passing through a duct having a solid barrier along the line x-x from a point far upstream to a stagnation point on the downstream side of the branch take-off.

Fig. 1—In a fitting designed to provide gradual expansion of the straight-through air stream simultaneously with bleeding of air to a branch duct, the flow would be as illustrated here. One stream of air exits through the take-off, and the other acts as though it were passing through a duct having a solid barrier along the line x-x shown in the sketch



Influence of Branch Take-off

For the case shown in Fig. 1, the upstream and downstream cross sections of the main duct are of equal area, yet the hydrodynamic system is similar to one in which a duct of area Z_1 is gradually expanded to area Z_2. The influence of a branch take-off is therefore to increase the apparent length of the expanding section and thereby reduce the turbulent loss. For the purposes of this paper the assumption is made that for all ordinary expansion sections, the static regain will amount to 50 per cent of the reduction in kinetic energy; this assumption is conservative when applied to ducts of usual design with branch take-offs located at the point of velocity reduction.

A third disadvantage of theoretical static regain design is that the

resultant optimum duct diameter may be any fractional or inbetween size. Again, the exigencies of practical design require that changes in duct diameter be through increments of an inch, or—in the most exact systems—through not less than one half inch. This requirement means that the amount of regain attained through a given velocity reduction can be either more or less than the amount actually needed to compensate exactly for the frictional losses in the subsequent section of duct. Thus, a practical design procedure for use with the static regain method will have to allow for a net static gain or loss in the duct section for which initial regain is to provide the greater part of the energy which subsequently is lost as friction. The design procedure established in this paper is one in which the designer is allowed to select arbitrarily an average net loss of static pressure per unit length of duct, and then design for an amount of static regain sufficient to maintain the average net loss at the selected value.

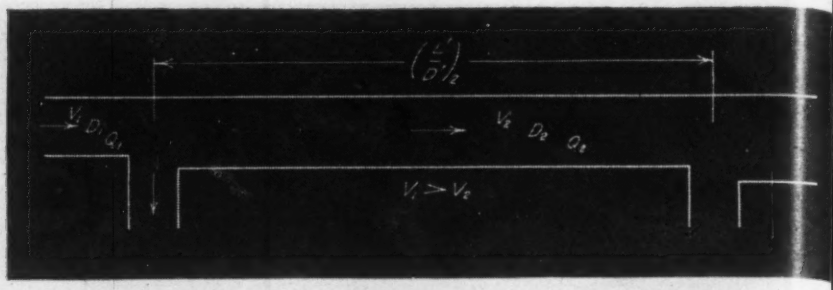


Fig. 2—This sketch illustrates the type of duct system for which the design procedure described here is applicable

Frictional Loss in Section of a Duct

The frictional loss in a given section of duct depends on the Reynolds Number (which in turn depends on velocity, pressure and indirectly on temperature) and on a roughness factor which (for roughnesses of relatively fixed amount such as occur on sheet metal) decreases as the duct diameter increases.

For ordinary design calculations, it has long been customary to express duct friction losses in terms of the fraction of a velocity head lost per unit length of duct or—more conveniently—as the length of duct in which a frictional loss of one velocity head will occur. Since loss varies with velocity, a more effective relationship is to fix the number of duct diameters in which unit velocity head is lost. Opinion on this subject is by no means unanimous as recommended values of the length-diameter ratio vary from 40 to 75; for reasonably conservative results, and to take account of normal imperfections such as occur in ordinary sheet metal duct construction, the graphical solution presented here is based on loss of one velocity head in a duct length equal to 60 diameters; if elbows or other fittings occur in the length of duct to be considered, their equivalent length should be added to the actual duct length in determining the value of L'/D' for use in the graphical solution.

The type of duct system for which the design procedure is applicable is shown in Fig. 2. The upstream duct can be of area less, equal, or greater than the downstream duct, but the velocity on the upstream side, V_1, must always be the greater. With allowance for a 50 per cent turbulent loss, the equation for evaluation of the upstream velocity required to provide the necessary static regain can be derived as:

$$V_1 = \left\{ [0.0333\ (L'/D')_2 + 1]\ (V_2^2) - 32{,}080{,}000\ (\Delta\ sp)_2 \right\}^{\frac{1}{2}}$$

where V_1 and V_2 are upstream and downstream velocities, respectively, expressed in feet per minute; $(\Delta\ sp)_2$ is the arbitrarily selected net loss of static pressure in the section of duct identified by the subscript 2; in case where the upstream velocity is arbitrarily selected, the value of $(\Delta\ sp)_2$ will then be determined from the graphical solution; and $(L'/D')_2$ is the ratio, in consistent units, of the length, or equivalent length, of duct section 2 to its diameter.

Data Sheet on Next Page

The data sheet on the next page is a graphical solution of the above equation. The upper of the four sections of the chart relates the diameter, velocity, and volume of air passing through the section of duct for which frictional losses are to be considered. The lower of the four sections is similar to the upper, but refers to conditions in the upstream section of duct. The second section down from the top provides a graphical procedure for evaluating the velocity head loss needed to overcome frictional resistance in section 2 of the duct whereas the third section down from the top of the graph takes account of the design value of the net static pressure loss in duct section 2.

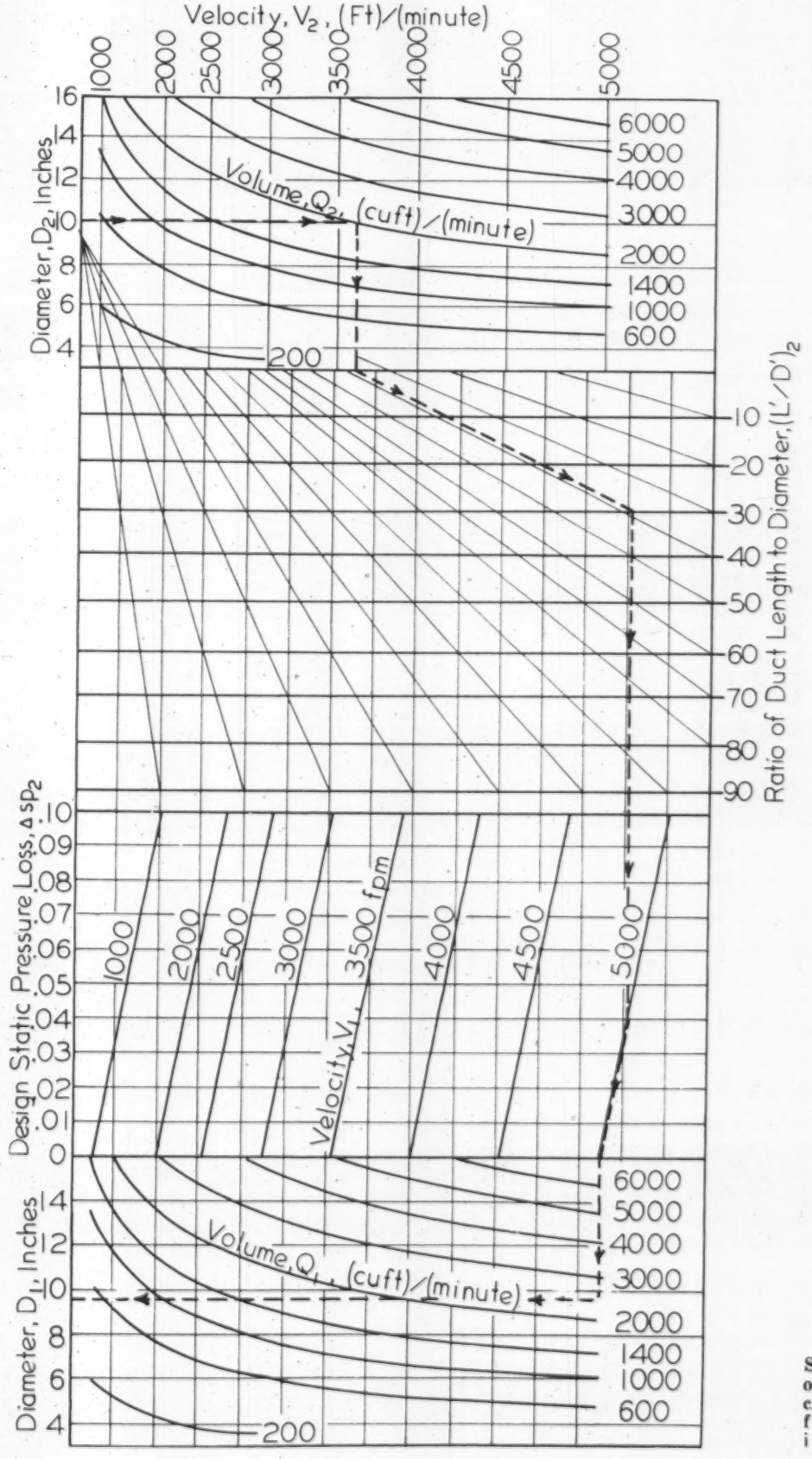
A GRAPHICAL solution is presented in this article and the data sheet which follows it to the problem of sizing ducts upstream from a duct section of given length for which part or all of the frictional losses are to be made up in the form of static pressure regain due to reducing the velocity of the upstream section at the point of entrance to the duct section in question. A numerical example is given in the data sheet (shown by a dashed line on the chart) and three additional uses of the chart are discussed. Assumptions underlying the equation from which the graph was constructed are that 50 per cent of the kinetic energy reduction which occurs during expansion is available as static regain and that frictional losses in ordinary sheet metal air duct can be taken as one velocity head for each 60 diameters of equivalent duct length. . . . Mr. Anderegg is vice president and chief engineer of the Trane Co., and Mr. Hutchinson is professor of mechanical engineering at Purdue University.

DATA SHEET

DUCT SIZING

By R. H. ANDEREGG, Vice President and Chief Engineer, The Trane Co., and
F. W. HUTCHINSON, Professor of Mechanical Engineering, Purdue University

Graphical Determination of Upstream Duct Diameter (or Velocity) by Static Regain Method



See examples of use of this chart on the following page.

DUCT SIZING With Partial Static Regain

THE article by R. H. Anderegg and F. W. Hutchison, starting on the fourth page preceding this one, explains the basis for this method of duct sizing with partial static regain, and the equation given at the end of that article is solved graphically in the accompanying chart.

There are several ways of using this chart to simplify problems met with sizing ducts. For example, consider that air is flowing through a 10 in. diameter duct at a rate of 2000 cfm. The duct length is 30 times its diameter and the net static loss in this section of duct is fixed at 0.04 in. Determine the required diameter of the duct section upstream from the one in question if it carries 2500 cfm and if static regain at the upstream take-off of the duct is just sufficient to overcome friction losses less 0.04 in.

Enter the graph on the preceding page at the duct diameter scale on the left side of the upper section and move horizontally to the right (as shown by the dashed example line) to the intersection with the line for 2000 cfm. From this point drop vertically to the bottom of this section of the graph, then follow a directrix line to the intersection with the horizontal corresponding to an L'/D' ratio of 30; from this intersection, move vertically down to intersect the horizontal line corresponding to a net static pressure loss of 0.04 in. At this intersection the necessary upstream velocity can be read as 5050 fpm. The diameter of the upstream section is determined by following a velocity line down from the above intersection to the base of this section of the graph, then dropping vertically to intersect the 2500 cfm line; from this intersection, move horizontally to the left to read the duct diameter as 9.6 in.

This example illustrates the use of the graph in solving the type of problem most common in static regain design. Many other types of problems can, however, be solved by proceeding through the graph by different paths. Some of these are as follows:

1) For a long duct without take-offs, to determine the velocity upstream from an expanding section to permit regain sufficient to overcome frictional losses in a section of known L'/D'. Enter the top scale of the graph at the known downstream velocity and move vertically downward to the base of this section, then follow a directrix to intersection with the known L'/D', and from this point rise vertically to intersect the top scale at the value of the required *upstream* velocity.

2) When conditions beyond the designer's control fix the diameters of both upstream and downstream sections of duct separated by a take-off and expanding section, to determine the net loss of static pressure in the downstream duct section. Enter the top section of graph as before at the value of the downstream diameter and move right to the intersection with the known downstream capacity. Then drop to the base and follow the directrix to the intersection with the known downstream L'/D'; from this point drop vertically to any point near the top of the bottom section of the graph. Now re-enter the graph at the diameter scale of the bottom section and move right to intersect the known upstream capacity. From this intersection rise vertically to the top of the bottom section of the graph and from here follow a velocity line to intersect with the vertical which was previously established. From this point of intersection, draw a line horizontally to the left to intersect the static pressure scale at the value of the net static loss which will occur in the downstream section of the duct.

3) A frequently occurring problem will be one in which the designer uses the chart to determine the diameter of the upstream duct necessary to meet an arbitrarily fixed net static loss, then finds that the answer differs by an odd fraction from a standard duct diameter. In this case he can obtain a second solution by fixing the upstream duct diameter at the nearest acceptable value (from the standpoint of practical construction) then repeating the analysis by the method described in paragraph (2) to find the actual net static loss when using the even duct size.

Heating, Piping & Air Conditioning

AMERICAN SOCIETY of HEATING and VENTILATING ENGINEERS

Journal Section

Hold-Fire Controls for Bituminous Coal Stokers †

By C. C. Wright*, T. S. Spicer**, and H. A. Baumann††

SUMMARY—The principles of hold-fire operation for bituminous coal stokers are described and the different conditions under which the hold-fire control must operate are discussed, especially those influencing performance during mild weather and during summer operation when the stoker boiler unit is used for service water production. Based upon laboratory and home tests and upon field surveys the conclusion is reached that improvement in hold-fire equipment would improve the overall performance and acceptance of bituminous coal stokers. The desirable operating characteristics of an improved control are listed. Test data are presented comparing the operation of several controls under a variety of conditions in furnace and boiler.

ONE of the major considerations associated with the satisfactory operation of the domestic stoker during mild weather is the ability of the stoker to maintain fire without causing any overheating of the home. This self-maintenance of ignition in solid fuel burning equipment is essential to satisfactory performance because no automatic ignition system, such as commonly used with oil and gas burning equipment, has yet been developed for coal stokers. During the summer, when the stoker may be used only for service water production, hold-fire control is a major factor in satisfactory performance because operation of the stoker on heat demand should occur only after major draw-offs of service water and these rarely occur more than once or twice a day. At all other times, the hold-fire rate should be equal to or less than the radiation losses of the boiler, piping, and hot water storage tank, otherwise some overheating of the home or loss of efficiency occurs.

The heat losses from the boiler, piping, and storage system will depend largely upon the nature of the system and the type of insulation provided. In home tests[1] completed some time ago on the production of service water in a stoker fired boiler, it was estimated that these losses for the particular system (insulated boiler, but uninsulated piping and storage tank) were equivalent to a coal consumption of approximately 0.7 lb per hour. More recent test data on the laboratory installation in which hold-fire tests were conducted indicate that this figure may be somewhat high for the average system and will more nearly approach 0.5 lb per hour. On the basis of these estimates, therefore, it appears reasonably certain that with a properly insulated system a hold-fire rate of 0.4 to 0.6 lb of coal per hour will maintain service water temperature except during draw-off periods.

Basic Principles of Hold-Fire Operation

During winter operation, there is little or no demand for hold-fire operation except possibly during the night, when day-night thermostats are used because the stoker operates primarily according to the thermostatic demand. During the remainder of the year, however, the hold-fire control is frequently the operating control. An examination of the conditions of hold-fire operation during different types of demand indicate that there are two basically different conditions that may prevail.

During mild weather, such as is

†A contribution from the Division of Fuel Technology of The Pennsylvania State College, State College, Pa. This investigation is part of a major program on Comfort Heating with Bituminous Coal and was sponsored jointly by the Commonwealth of Pennsylvania through its Department of Mines, the *Western Pennsylvania Coal Operators Association* and the *Central Pennsylvania Coal Producers Association*.

*Professor, Department of Fuel Technology, The Pennsylvania State College.

**Assistant Professor, Department of Fuel Technology, The Pennsylvania State College.

††Research Assistant, Department of Fuel Technology, The Pennsylvania State College.

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[1]Exponent numerals refer to bibliography.

common during early fall and late spring, the hold-fire control functions as the operating control for a few hours each day, after which the heat demand (thermostat) control again becomes the operating control. Depending upon the characteristics of the stoker and the coking properties of the coal, the fairly heavy firing periods occurring during the early morning tend to build up a fuel bed of from 5 to 20 lb of coal and coke which acts as a reserve during the subsequent hold-fire period. Although in terms of quantity this reserve of fuel is usually adequate to maintain the fire for several hours, some form of hold-fire control is necessary to insure periodic operation of the stoker and maintain ignition of this fuel.

During the summer, when the stoker boiler combination is used for service water production, the hold-fire control functions as the primary operating control for long periods of time with only short and infrequent heat (aquastat) demand periods interspersed. Under these conditions little or no reserve of fuel is present in the firebox and the fire is maintained on the coal fed during the hold-fire operating periods.

Hold-Fire Equipment Available

There are in use two basically different classes of hold-fire equipment. The more commonly used is the time control which functions on the principle of periodic operation at predetermined time intervals. The second class depends for its operation on changes in temperature affecting a temperature sensitive element which in turn actuates the operation of the stoker.

Time Controls

There are numerous time lapse hold-fire devices available, including the clock, electrical resistance and hydraulic types, having various degrees of refinement and accuracy; the general principles of their design are fairly well known and require no elaboration. With this class of control it is possible to set the time lapse mechanism so that it will operate the stoker for a predetermined number of minutes per cycle. In the early controls, this cycle was usually one hour, but with all but the most freely burning bituminous coals it was found that a one hour cycle was usually inadequate and, therefore, most of the controls now used for bituminous coal stokers can be set to operate on at least a half hour cycle while several operate on one quarter hour cycles. In the better type of time lapse controls, the hold-fire control is automatically reset to zero at the end of an operating period so that the hold-fire cycle starts from this point.

It is frequently claimed that with free burning coals this type of control will maintain fire on an operating cycle of 1½ to 2 min per hour or in terms of coal fed, 0.5 to 0.6 lb per hour. No reliable test data appear to have been published which substantiate this claim and the experience of the authors based for the most part on the use of coking coals would indicate about 1 lb per hour as the minimum and 1.5 to 2.0 lb per hour as the average. Field surveys in the area where strongly coking coals are normally used indicate that 3 to 4 lb per hour is not an uncommon requirement to insure maintenance of ignition and that 15 or 30 min cycles are almost essential.

Temperature Controls

The other major class of hold-fire control is actuated not on a time lapse basis, but rather by changes in temperature of either the firebox or the stack gases. In general, the stack temperature type has not proved satisfactory for coal fired units because the control response bears little relation to the need of the fire for attention and the only temperature actuated units now used extensively are those whose operation depends upon firebox temperature.

In this type of control, a heat responsive element is inserted into the firebox. When the temperature of the firebox falls below some preset minimum, the element actuates the control, causing the stoker to operate until the firebox temperature rises to some preset maximum, at which point the control stops the stoker operation.

Since this class of control depends only on firebox temperature, it should not only be much more reliable for maintaining the fire and preventing overheating of the home, but should also be much more efficient, because the only calls for operation will occur when the fire actually needs attention. In home tests,[1,2] it has been found possible, when using this type of control, to obtain satisfactory performance at a hold-fire rate of 1.3 to 1.5 lb per hour even with some of the strongly coking coals, while in the laboratory on prolonged hold-fire operation with no interspersed heat demands, satisfactory operation was maintained for two weeks at a rate of 0.7 lb per hour on a similar coal.

When used in the present type of furnace or boiler fired with the clinkering type stoker, this type of control possesses the disadvantage of being located in the firebox usually inserted through the fire door, where it may be damaged by careless use of the clinker tongs. When used with automatic ash removal stokers, however, no such disadvantage exists. In the design of future furnaces and boilers intended for stoker firing, it is to be hoped that some provision will be made for insertion of the temperature type control in a more convenient and less exposed location. Unfortunately, the only control of this type available prior to the war was so constructed mechanically that the heat element was subjected to load when the fire was hottest and despite use of alloy material in construction, the control did lose adjustment and sensitivity. Experience with a number of these units in home and laboratory tests indicated their useful life, even when readjusted each year, was only about 3 to 5 years and, where abnormally high firebox temperatures were encountered, as short as a full heating season.

In consideration of test results discussed later and from experience with a variety of hold-fire controls, the authors outlined in 1942 the requirements for an improved control which, it was believed, would overcome a number of the deficiencies of existing units. These requirements, later submitted to a number of control manufacturers, were as follows:

1. A temperature actuated control is highly desirable.

2. The unit must be so constructed that the heat responsive element does not lose adjustment or sensitivity because of load at high temperatures (up to 1400 F) or for other reasons

3. The unit should be so designed that when changing from a firing cycle to hold-fire operation, the control will have some mechanism for increasing the hold-fire rate during the transition period so that ignition will not be lost due to more rapid cooling of the fire than of the furnace refractories or castings.

4. The unit should have a built-in outfire control to prevent feeding of coal in case the fire does for any reason go out. Failure of electric power supply during the summer months may occur in certain localities and, if prolonged, may cause the fire to go out.

5. The unit should be adjustable for both cut-on (minimum) temperature and differential so that it will be applicable for all classes and sizes of furnaces and boilers.

6. The frequency of operation of the control on normal hold-fire operation should not be oftener than about four times per hour.

7. Mercury type toggle switches should be eliminated, if possible, because of their tendency to cause radio interference under certain conditions, which would prove objectionable in the home.

8. The unit must be competitive in price range with the better quality controls now marketed.

A control meeting the foregoing specifications has been designed and is under laboratory and field tests. This unit, the basic elements of which are shown diagrammatically in Fig. 1, has been subjected to extensive laboratory tests by the authors during the past year and has so far fulfilled all the requirements outlined, except that insufficient data are available as yet to establish the life of the unit.

The general principles of operation of the control shown diagrammatically in Fig. 1 are as follows:

During normal hold-fire operation the moving arm C, to which is attached arm C' carrying the clutch cam H, is in the second or rear notch on cam H. As the firebox temperature falls, the heat responsive element A causes the moving arm C together with arm C' and clutch and cam H to pivot on the fixed knife edge forcing the spring arm E to make contact with the fixed contact F. This completes the electrical circuit and energizes a relay (not illustrated) which actuates the stoker. As the temperature of the firebox rises, pressure on arm C decreases and arms C and E pull away from the contact F. The power circuit, however, is maintained by means of a jumper in the relay until pressure on arm C is reduced to the point where C pulls away from spring arm E. The distance between E and F is, therefore, the differential on which the control operates and is adjustable.

In case of a heat run, the relay is energized independently of the hold-fire control and as the firebox temperature rises, the spring S maintains tension on the moving arm C and draws it back toward stop G. The clutch cam H comes into contact with the stop and due to the shape of the cam, is tilted into position to release moving arm C from the second or rear notch and permits it to drop into the first or front notch as the cam H passes under the stop G. This occurs at about 900 F with this particular control. When the moving arm C reaches stop G, the cam has righted itself due to the upward pull of a spring T which connects arm C and cam H, locking arm C into the first notch. After the heat run is over, the firebox cools and the pressure on arm C by the heat responsive element forces arm C toward contact F where contact is eventually made as in the normal hold-fire operation. However, being on the first notch instead of the second on cam H, contact C-E-F is made at a temperature higher (100 F in this particular instrument) than normal. After the operating run with clutch set, the circuit is broken in the usual manner and as arm C pulls away from E the rear of the cam H contacts stop G. This trips the cam so that arm C drops back into the second or normal hold-fire operating notch. The control then operates as a normal temperature actuated control until another heat demand occurs.

Test Equipment and Procedure

Four types of hold-fire controls have been tested. These include a number of time lapse devices, a stack temperature control, standard firebox temperature controls, and the firebox temperature control having the clutch device shown diagrammatically in Fig. 1.

Operation has been studied under a variety of conditions including extended hold-fire periods of a week or more in duration, hold-fire periods immediately following a short operating period sufficient to raise the firebox temperature to about 1000 F (a type of operation commonly encountered during summer service water demand) and hold-fire operation following a prolonged firing period of 15 min or more (mild weather type operation).

One series of tests was conducted using a steam boiler, 530 sq ft EDR, connected to a unit heater, rated 650 sq ft EDR and to an indirect service water heater. The boiler was fired with a 20 lb per hour clinkering type stoker modified to incorporate the preoxidation principle‡ for control of coke tree formation[3] which produces a relatively flat bed and burns the coal substantially as fast as fed. The coals used in these tests included Pittsburgh seam 1 in. x 0, Upper Freeport seam ¾ in. x 0 and Lower Kittanning seam ¾ in. x 0. All the data herein reproduced are for the Lower Kittanning seam coal, although the results were substantially the same with all the coals tested.

Another series of tests was conducted using a gravity warm air furnace of 81,000 Btu per hour rating operated with air ducts

‡Preoxidation Principle—A portion of the total air required for combustion is introduced near the base of the stoker retort and is mixed with the coal by means of a vertical coal elevating screw. As the aerated coal passes into the heated section of the retort, the oxygen in the air oxidizes the surface of the coal and impedes agglomeration of the particles, thus producing a more free burning coke and eliminating coke tree formation.

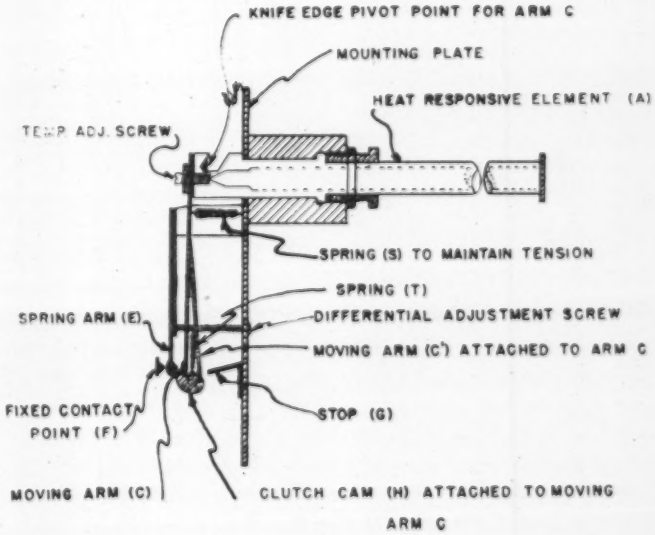

KNIFE EDGE PIVOT POINT FOR ARM C
MOUNTING PLATE
HEAT RESPONSIVE ELEMENT (A)
TEMP. ADJ. SCREW
SPRING (S) TO MAINTAIN TENSION
SPRING (T)
DIFFERENTIAL ADJUSTMENT SCREW
SPRING ARM (E)
MOVING ARM (C') ATTACHED TO ARM C
FIXED CONTACT POINT (F)
STOP (G)
MOVING ARM (C)
CLUTCH CAM (H) ATTACHED TO MOVING ARM C

Fig. 1 — Diagrammatic sketch of firebox temperature actuated hold-fire control with clutch device to bridge transition from heat run to hold-fire operation

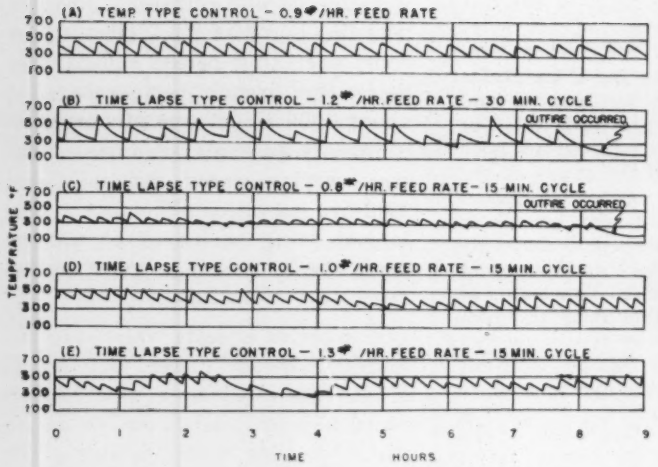

(A) TEMP. TYPE CONTROL - 0.9#/HR. FEED RATE
(B) TIME LAPSE TYPE CONTROL - 1.2#/HR. FEED RATE - 30 MIN. CYCLE
OUTFIRE OCCURRED
(C) TIME LAPSE TYPE CONTROL - 0.8#/HR. FEED RATE - 15 MIN. CYCLE
OUTFIRE OCCURRED
(D) TIME LAPSE TYPE CONTROL - 1.0#/HR. FEED RATE - 15 MIN. CYCLE
(E) TIME LAPSE TYPE CONTROL - 1.3#/HR. FEED RATE - 15 MIN. CYCLE
TEMPERATURE °F
TIME
HOURS

Fig. 2—Extended hold-fire tests in gravity warm air furnace showing firebox temperatures using two types of hold-fire controls

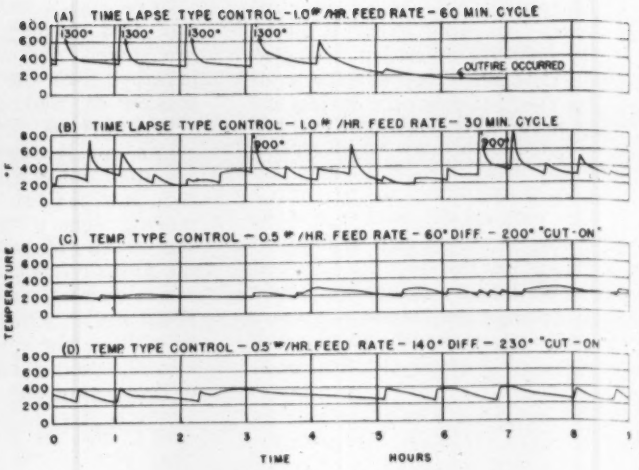

(A) TIME LAPSE TYPE CONTROL - 1.0#/HR. FEED RATE - 60 MIN. CYCLE
300°
OUTFIRE OCCURRED
(B) TIME LAPSE TYPE CONTROL - 1.0#/HR. FEED RATE - 30 MIN. CYCLE
200°
(C) TEMP. TYPE CONTROL - 0.5#/HR. FEED RATE - 60° DIFF. - 200° "CUT-ON"
(D) TEMP. TYPE CONTROL - 0.5#/HR. FEED RATE - 140° DIFF. - 230° "CUT-ON"
TEMPERATURE °F
TIME
HOURS

Fig. 3—Extended hold-fire tests in a steam boiler showing firebox temperatures using two types of hold-fire controls

open. The furnace was fired with an ash removal stoker set at a 17 lb per hour feed rate. This unit also incorporated the preoxidation principle. Only data for tests on the Lower Kittanning seam, ¾ in. x 0, coal are reproduced for this series of tests, although Pittsburgh seam, 1 in. x 0, was also tested and gave substantially the same results.

In both furnace and boiler tests, the maximum draft was set at 0.04 in. water gage by means of an automatic draft control. During the hold-fire periods, however, much lower drafts were experienced because stack temperature was relatively low.

Firebox temperatures in the boiler were determined by means of a calibrated unshielded thermocouple inserted through the fire door a distance of 6 in. at a height of 15 in. from the hearth. In the furnace test the thermocouple was inserted through the fire door a distance of 5 in. at a height of 18 in. from the grate. Temperatures were recorded by means of a strip chart recording instrument and also by means of an indicating pyrometer connected in parallel with the recorder.

Experimental Results

The experimental results are shown in Figs. 2 to 7 inclusive for extended hold-fire, socalled summer type operation, and mild weather operation in both furnace and boiler. The plots shown are traced directly from strip chart records except in the case of Fig. 5, where a study was being made of the temperatures of cut-on, cut-off and the extent of overshooting during summer type operation. In these cases, the data are plotted from indicating pyrometer readings taken frequently enough to permit accurate reproduction of the temperature cycles over the periods involved.

Discussion of Results

Extended Hold-fire

Furnace Tests. Using the time lapse control and operating on a 30 min cycle, outfires resulted in less than a full day when operating at 1.0 and 1.2 lb per hour feed rates. The data are reproduced in Fig. 2 only for the latter where fire was maintained for nearly a full 24 hours. Fire could probably have been maintained indefinitely on this cycle at an operating rate of about 1.5 to 1.7 lb per hour, but such tests were not completed because these rates are much higher than desirable. When operating on a 15 min cycle, the fire was held for a day at an 0.8 lb per hour rate, but on the second day an outfire resulted as shown in Fig. 2. Satisfactory operation was, however, obtained at 1.0 and 1.3 lb per hour feed rates.

Using the temperature actuated control, satisfactory hold-fire operation was maintained at a 0.9 lb per hour feed rate. A major reduction in the cut-on temperature did not, however, result in an expected decrease in fuel consumption, and this suggests that the 0.9 lb per hour rate is approximately equal to the hold-fire rate necessary to meet the heat losses of this particular installation.

Boiler Tests. As shown in Fig. 3, the fire held satisfactorily with the time lapse control on the 30 min cycle at a rate of 1 lb per hour. Similar results not reproduced were obtained on the 15 min cycle at the 1 lb per hour rate, but on the 60 min cycle at this rate, an outfire resulted in a few hours. At rates of 0.7 lb per hour outfires resulted on the 30 and 60 min cycles but no test has been completed on the 15 min cycle. Using the temperature actuated control, hold-fire rates as low as 0.4 lb per hour were maintained for over two weeks with no apparent difficulty. Fig. 3 shows two sets of operating data, one with a short 60 F differential between cut-on and cut-off and the other with a 140 F differential. The marked difference between the operating characteristics of the time lapse and temperature type controls is apparent.

From these data on furnace and boiler tests it would appear that for extended hold-fire operation where no previous reserve of fuel is available to assist in maintaining fire, the time lapse control may give reasonably satisfactory performance when set on a short operating cycle. It appears to be a characteristic of this type of control that the firebox temperature follows a flattened sine wave, the period and amplitude of which increase as the length of the cycle increases. This cyclic rise and fall in the firebox temperature at the time of cut-on results in outfires many times when the average firebox temperature

over the period is more than sufficient to expect satisfactory hold-fire operation and high enough in many cases to produce overheating.

With the temperature actuated control somewhat better results are obtained because no sine wave operation is possible. If the cut-on temperature is set slightly above the firebox temperature necessary to maintain ignition with the particular coal, stoker and furnace or boiler, the fire will hold indefinitely.

Comparing the data for tests with the furnace and with the boiler, it will be noted that the permissible hold-fire rate setting is appreciably lower for the latter. It will also be noted that the general shape of the operating curves for the furnace and boiler tests are quite different when using the temperature actuated control. Both effects are due to the different rates of heat loss from the fuel bed in the two installations. In the furnace, the radiation and convection losses, which must be met by feeding and burning fuel, are greater than the radiation losses in the boiler. In the latter equipment, operation of the stoker is required principally to maintain ignition of the fuel and to replenish the small quantity of coal burned in maintaining ignition, while in the former, operation is required principally to maintain a fuel bed sufficient to meet the heat losses. The differences between furnace and boiler operation would be expected to be less when using a forced air system because convection losses would be somewhat reduced in this type of equipment. Tests have not yet been made to substantiate this belief.

Summer Type Operation

Furnace Tests. Test results on summer type operation using the time lapse control on a 15 min cycle gave satisfactory performance at a 1.0 lb per hour hold-fire rate, as shown in Fig. 4. On the 30 min cycle, however, an outfire occurred about 10 hours after the short operating run, at the first low point in the sine wave cycle. Although the data shown in Fig. 4 do not include the outfire, its occurrence indicates that this hold-fire rate is too low to maintain fire under these operating conditions. It is apparent from both of these time lapse tests that considerable overheating of the home would occur from operating at the hold-fire rates tested. Since furnaces are not generally used for service water production during the summer, this particular test is only of significance as indicating what may be expected during mild weather after even the shortest of operating periods.

The simple temperature actuated control not equipped with clutch action to give the fire a boost during the cooling period between peak temperature and normal hold-fire temperature gave results worse than did the time lapse control. The fire was out by the time the control called for operation. In this particular test, the outfire occurred 40 min after the heat run and at least 20 min before the control called for operation. Obviously the outfire would have been prevented if the cut-on temperature had been raised 60-80 F, but this would have resulted in a hold-fire rate appreciably higher than 0.9 lb per hour. Although the time lapse control was not tested on the 60 min cycle, it is obvious from the foregoing data that an outfire would have resulted on this cycle at the 0.9 or 1.0 lb per hour rate before the control called for operation.

As may be seen from the data shown in Fig. 4, the overheating difficulties inherent in the time lapse method of hold-fire control are eliminated to a large extent by using the clutch device in conjunction with the temperature actuated control. Not only is it possible to operate on a lower hold-fire setting as has been shown for extended hold-fire operations, but after a short operating period the firebox temperature returns rapidly to normal hold-fire temperature. The extra boost given to the fire about 100 to 150 F above normal hold-fire temperature adds very little to the average firebox temperature, yet is adequate to prevent the outfire frequently experienced with the simple temperature actuated control without clutch device.

Boiler Tests. In the tests reproduced in Fig. 5 the data were taken from indicating pyrometer readings of cut-on, cut-off and maximum temperatures following each operating period in order to study more carefully the temperature variations occurring. Only four hours of test are plotted although in all cases the tests were continued for a day or more and the fires were held satisfactorily.

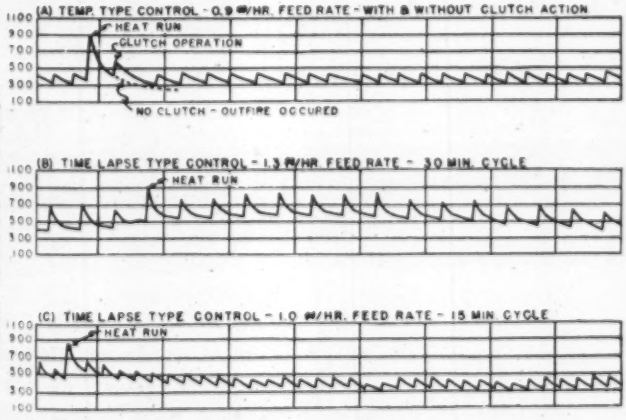

(A) TEMP. TYPE CONTROL - 0.9 #/HR. FEED RATE - WITH & WITHOUT CLUTCH ACTION
HEAT RUN
CLUTCH OPERATION
NO CLUTCH - OUTFIRE OCCURED
(B) TIME LAPSE TYPE CONTROL - 1.3 #/HR. FEED RATE - 30 MIN. CYCLE
HEAT RUN
(C) TIME LAPSE TYPE CONTROL - 1.0 #/HR. FEED RATE - 15 MIN. CYCLE
HEAT RUN
FIRE BOX TEMPERATURE - °FAHRENHEIT
1100
900
700
500
300
100

Fig. 4—Summer type hold-fire operation in a gravity warm air furnace at various rates showing firebox temperature conditions immediately following a short operating run

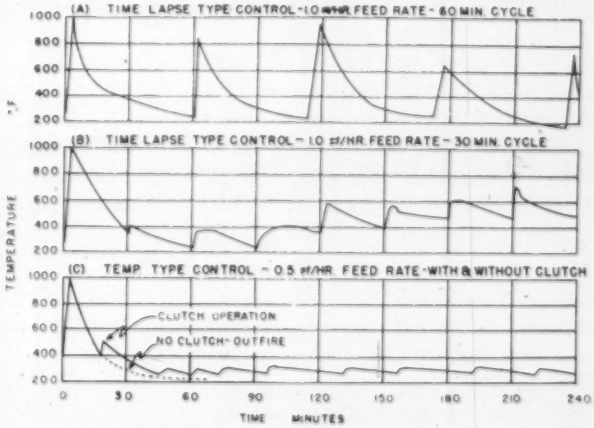


Fig. 5—Summer type hold-fire operation in a steam boiler at various rates showing firebox temperature conditions immediately following a short operating run

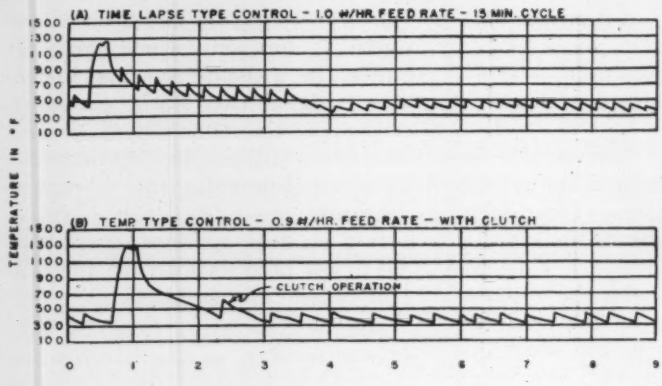

(A) TIME LAPSE TYPE CONTROL - 1.0 #/HR. FEED RATE - 15 MIN. CYCLE
(B) TEMP. TYPE CONTROL - 0.9 #/HR. FEED RATE - WITH CLUTCH
CLUTCH OPERATION
TEMPERATURE IN °F

Fig. 6—Firebox temperature conditions in a gravity warm air furnace immediately following a 15 min heat run, using two types of hold-fire controls

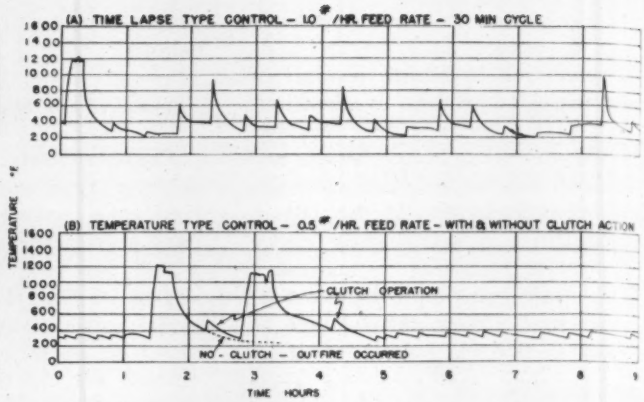

(A) TIME LAPSE TYPE CONTROL - 1.0 #/HR. FEED RATE - 30 MIN CYCLE
(B) TEMPERATURE TYPE CONTROL - 0.5 #/HR. FEED RATE - WITH & WITHOUT CLUTCH ACTION
CLUTCH OPERATION
NO - CLUTCH - OUTFIRE OCCURRED
TEMPERATURE °F
TIME HOURS

Fig. 7—Firebox temperature conditions in a steam boiler immediately following a 15 min heat run, using two types of hold-fire controls

These data show the marked difference in firebox temperatures when operating on the different time cycles and on the firebox temperature type control. It is especially interesting to note that on the 60 min cycle the firebox temperature dropped to 185 F at the end of the third hold-fire cycle, which is at least 15 F below what is considered the safe minimum operating temperature. Similarly on the 30 min cycle relatively poor response to the *on* periods was obtained on the first and second cycles until a small reserve of fuel had accumulated which was ignited on the third cycle and continued to burn during the subsequent *off* period. The amount of coal fed and burned during the time control tests was at least twice that necessary for normal hold-fire yet a lower setting was not possible because of the conditions discussed.

Mild Weather Operation

Furnace Tests. Fig. 6 shows the strip chart records for tests with the time lapse type control operating on a 15 min cycle at a hold-fire rate of 1 lb per hour, and for the temperature actuated control with clutch action operated at a 0.9 lb per hour hold-fire rate. The marked difference in firebox temperatures is at once apparent. For the time cycle, fire was almost lost about 3½ hours after the 15 min heat run due to the fact that the high firebox temperatures caused the fuel to burn faster than it was being fed. With the temperature actuated control, however, this control did not call for operation of the stoker for 70 min while the firebox cooled to 400 F where a short operating period on clutch occurred sufficient to hold the fire until normal hold-fire was attained some 50 min later. Had the clutch not caused a short run at this time, the fire would have been lost. In this particular installation with the particular coal tested, it has been found that the fire will lose ignition about 85 to 90 min after a heat run.

Boiler Tests. Similar data for the tests with both types of controls in the boiler are shown in Fig. 7. For the time lapse type control, only the data for the 30 min cycle at the 1 lb per hour feed rate are reproduced, although a test on the 15 min cycle was completed and resulted in satisfactorily maintaining the fire for at least a full day of operation. A test using the 60 min cycle at the 1 lb per hour feed rate gave satisfactory operation until the reserve of fuel burned out, after which an outfire resulted as with extended hold-fire on this cycle.

For the temperature actuated control, tests were made with and without clutch action. The latter resulted in an outfire which occurred approximately 70 min after completion of the heat run at a firebox temperature of 360 F, or some 80 F above normal hold-fire cut-on temperature.

To demonstrate the effectiveness of the clutch action in maintaining fire under adverse conditions, two 15 min heat runs were made in the test reproduced in Fig. 7. The second 15 min run was started as soon as the firebox temperature had dropped to that of normal hold-fire. As may be seen, the fire responded well and held satisfactorily on subsequent hold-fire.

The marked difference between the firebox temperatures when using the two different types of controls is immediately apparent. With the time control, the temperatures reached 600 F or higher on six of the subsequent hold-fire operating cycles and during a substantial portion of the nine hours following the heat run the firebox temperature was above 400 F. In comparison, the temperature control permitted the firebox to cool to 400 F in 60 min after the second 15 min heat run and had reached normal hold-fire of 280 F cut-on, 320 F cut-off temperature in 100 min.

Similar results have been obtained after heat demand periods of longer than 15 min except that the reserve of fuel thus built up was greater and the time lapse type of control tends to hold the firebox temperatures higher for longer periods while the temperature actuated control attains normal hold-fire a little more slowly. The greater the reserve of fuel in the firebox the greater the difference in the extent of overheating between operation with the two types of controls.

Conclusions

The results of tests with a number of different types of hold-fire controls under a variety of operating conditions in different types of heating equipment have demonstrated that hold-fire controls actuated by changes in firebox tem-

peratures are intrinsically capable of more reliable and efficient operation with less danger of overheating the home than are the time lapse type or stack temperature type controls.

The standard type of firebox temperature actuated control fails, however, to render the effective performance possible, because during the transition period from heat demand operation to hold-fire operation, the fuel bed will frequently cool faster than the surrounding refractories or castings and loss of ignition will occur under certain conditions before the temperature control calls for operation, unless the cut-on temperature and, therefore, the hold-fire rate is appreciably higher than required for normal hold-fire operation.

A new firebox temperature actuated control with a clutch device to bridge the transition period from heat run to hold-fire operation has been found to overcome the deficiency of the standard control. This control permits satisfactory, safe and efficient operation at hold-fire rates appreciably lower than any previous control tested. The use of controls of this type may be expected to improve the reliability and efficiency of bituminous coal stoker performance during mild weather and summer service water operation and to increase consumer satisfaction with bituminous coal stokers. (*See p. 119 for discussion.*)

Bibliography

1. Heating Domestic Service Water with Bituminous Coal, by T. S. Spicer, F. F. Dennis and C. C. Wright, *Mineral Industries Experiment Station Bulletin No. 37*, (1943).

2. The Performance of a Completely Automatic Domestic Bituminous Coal Stoker in Laboratory and Home Installation Tests, by T. S. Spicer, J. M. Pilcher, C. C. Wright and A. W. Gauger, *Mineral Industries Experiment Station Bulletin No. 35*, (1942).

3. Control of Coke tree Formation in Domestic Underfeed Stoker, by C. C. Wright and T. S. Spicer, *Mineral Industries Experiment Station Technical Paper No. 79* (1942). *Transactions, American Institute of Mining and Metallurgical Engineers, 149*, 270-282 (1942).

SAFE USE OF RUBBER CEMENTS*

The problem of protecting the health of workers in industries using rubber cements is twofold in character.

The first of these is the protection of workers against acquiring dermatitis from the action of the solvent on the skin. Organic solvents are generally good solvents for fat. Removal of fats from the skin may leave the skin dry, make it crack readily and irritate it, as well as leave it open to secondary infections. Workers should exercise care to avoid coming into contact with solvent rubber cements as much as possible. Dried cement should be removed from fingers by rubbing rather than by dissolving off with solvents. Personal cleanliness aids in keeping the skin of the hands in good condition. Employers should provide soap, water and towels and encourage their employees to clean up thoroughly before they leave the premises. Protective hand creams of the proper type may also be provided for those who wish to use them.

The second safeguard required to protect the health of workers using or near those using solvent rubber cements is the prevention of the inhalation of solvent vapors in concentrations sufficient to cause occupational disease, or sufficient to act as mild anaesthetics so that workers are made more prone to accident, or even in concentrations sufficient to be obnoxious to the worker.

Table 1 lists the solvents most commonly found in solvent rubber cements used in the manufacture of shoes and slippers and the vapor concentrations in air which, if not exceeded, will, in our opinion, be safe for most people to be exposed to over a period of eight hours per day, five to six days per week when they are doing a moderate amount of work. These figures in parts per million (ppm) by volume are only approximate because the effects produced are highly individual and may depend on such other factors as age, sex, fatigue, indulgence in alcoholic beverages, taking of drugs or medication and rate of work. However, they are useful since they act as guides for control of the vapors released in cementing.

*Abstracted from N. Y. State Dept. of Labor, Division of Industrial Hygiene and Safety Standards, *Monthly Review*.

Table 1—Solvents Found in Rubber Cements

Solvent	Maximum Permissible Concentration
Petroleum Naphthas	1,000 ppm
Benzol	50
Toluol	400
Xylol	200
Cyclohexane and methylcyclohexane	400*
Acetone	1,000
Methyl ethyl ketone	500
Carbon tetrachloride	75
Trichlorethylene	200

*There are little data on the effect of these compounds on human beings. The figure given here is merely an approximation based on the best data available.

CRYOGENIC LABORATORIES*

The world-famous cryogenic laboratory of the University of Leiden, founded by Kammerlingh Onnes in the 1890's, may be said to be the first laboratory connected with low temperature research in the modern sense.

The first real cryogenic laboratory in this country and the only one in existence in 1901 was in the chemistry department of Wesleyan University, Middletown, Conn.

In 1925 only two laboratories in the world were equipped to work with liquid helium (boiling point 4 deg above absolute zero).

Today, 14 laboratories in America alone are equipped for work with liquid hydrogen and 7 of these have facilities for producing liquid helium. Two are equipped with magnetic cooling cycles (to within 0.001 deg of the absolute zero).

*Abstracts from the Engineering Experiment Station News, The Ohio State University, June 1946.

Chemical Removal of Scales, Sludges and Oxides

By Guy F. Williams*, Tulsa, Okla.

SUMMARY—Scale, sludge and oxide removal by proper application of chemical solvents is practicable and has many advantages among which are: thorough cleaning of complicated and inaccessible passages and piping; elimination of need for dismantling piping; and reduction of out-of-service time.

Special portable equipment has been developed to deliver and pump the solvents used in the cleaning process. Examples are given to illustrate the successful application of the solvent cleaning method to various types of installations.

THE chemical method of removing scales, sludges and oxides by use of chemical solvents to dissolve and disintegrate the accumulations is now being used by many engineers and plant managers who are responsible for all types of industrial equipment.

Proper chemical cleaning offers many advantages.

To be assured of successful results by chemical treatment it is necessary to know the solubility of the scale which is to be removed. The usual test is to determine the solubility in the more common solvents. If the scale exhibits low solubility in these solvents it is analyzed to determine its composition. Usually the x-ray method of analysis is used as this method is rapid and provides the necessary information required to prepare the solvents that will permit maximum solubility.

The x-ray diffraction method for the quantitative identification of the chemical composition of crystalline materials is very satisfactory in this type of work, as it determines the actual composition of the scale. Most scales, sludges and oxides found in heat exchange equipment can be removed chemically. In some instances, where high percentages of sulphates are encountered in the deposit, the scale is removed only with difficulty and if a large amount of silicates are present also the chemical method of removal will not be indicated. Fortunately, such accumulations are not found very often and pretesting of the deposits will always give an accurate indication of the effectiveness of the chemical solvents.

The solvents used in scale removal work generally have an acid base, but alkaline and organic solvents are also used. Several auxiliary agents may be used in the base solvent to expedite the chemical reaction. These might include inhibitors, intensifiers, wetting agents and dispersing compounds. By the proper combination of these various chemicals and by using the proper treating technique it now is possible to remove nearly any type of scale encountered in industrial plants.

Inhibitors designed to protect the metal during treatment are added to the solvent and must be adapted to the metals in the vessel or system and to the type scale being removed.

The method of scale removal used by a large service company involves the selection of the proper chemical solvents to dissolve and disintegrate the scale and use of proper inhibitors to protect the metal in the vessel or system. The vessel to be cleaned is filled with the solvent and, after a soaking period sufficient to dissolve the scale, the spent solvent is flushed from the unit.

Motorized units are equipped with large metal tanks for transporting the necessary chemicals and with pumps for pumping the prepared solvent into the industrial equipment to be cleaned. Each treating unit has a proportioning apparatus for diluting the solvent with water obtained on the premises and apparatus for adding auxiliary chemicals. A heater which raises the temperature of the prepared solvent is also part of the equipment. Fig. 1 shows a typical mobile treating unit.

The effectiveness and speed of

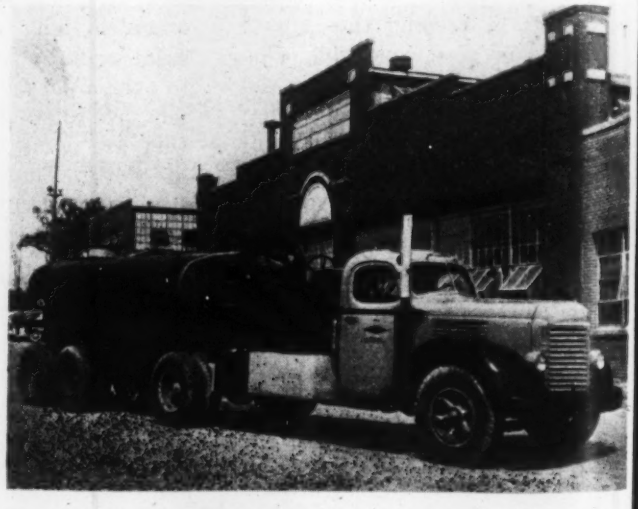


Fig. 1—Large mobile, combination transport and pumping units for chemical scale removal

*Development Engr., Dowell, Inc., Subsidiary of The Dow Chemical Co.

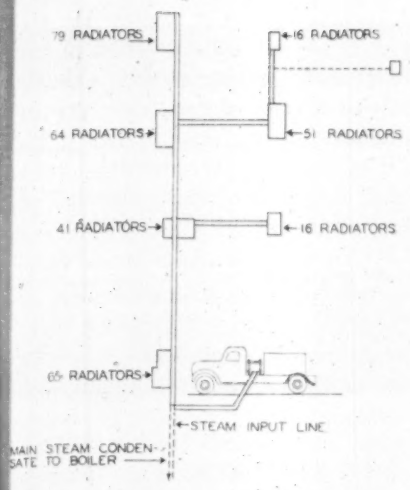


Fig. 2—Hook-up for treating 4 miles of radiator discharge and condensate return lines and 332 heating radiators

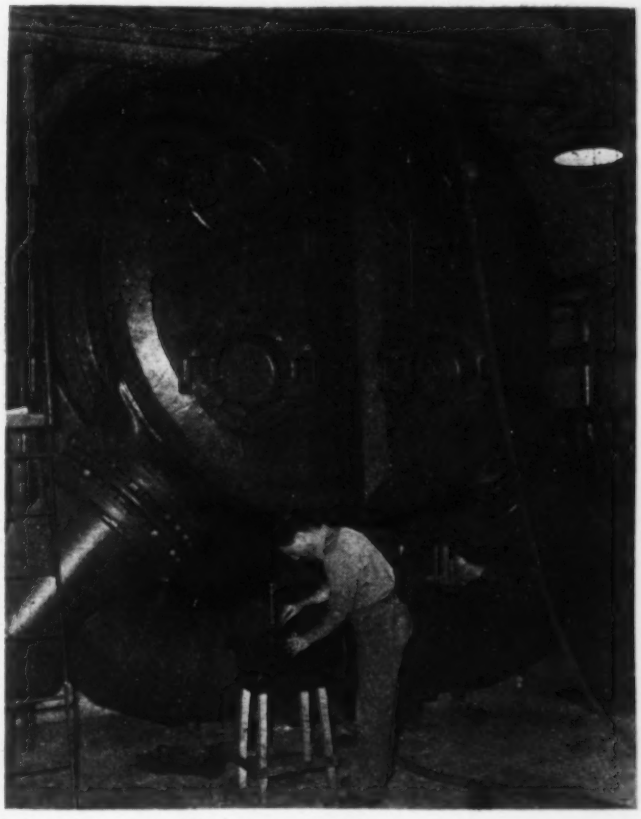


Fig. 4—With the turbine operating at 80 per cent of rated capacity this large surface condenser was cleaned in a few hours

the chemical method of removing scale deposits can be illustrated by the case of a large midwestern manufacturing plant where 20,000 ft of radiator discharge and condensate return lines and 332 steam heating radiators in seven large buildings were subjects for cleaning (see Figs. 2 and 3). Visual examinations of the equipment to be cleaned showed heavy deposits with as much as 40-50 per cent of the space in lines occupied by a hard, tightly adhering scale. The entire cleaning operation took approximately 160 hrs. Based upon the quantity of solvent required to complete this work it is estimated that nearly 7000 lb of scale were removed.

Condensers are among the types of industrial equipment in which chemical cleaning is used. The chemical removal of water deposited scales from the cooling surfaces of tube and shell type condensers is a routine problem and presents no real difficulty when proper equipment is used. In one plant 36 condensers containing hundreds of ¾ in. x 16 ft tubes were cleaned in less than 12 hours at a cost of less than 13 cents per tube. Surface condensers of the type illustrated in Fig. 4 have been cleaned while operating at 80 per cent of capacity. Turbine condensers with surface areas as high as 90,000 sq ft of condensing surface have been satisfactorily cleaned in less than 10 hours. In condenser cleaning neither complexity of construction nor size of unit is a handicap to chemical cleaning (see Fig. 5).

All types of cooling and air conditioning equipment are subject to scale deposits in the form of carbonates, oxides, small amounts of silicates and other compounds. The cooling water is difficult to treat chemically to prevent scale deposition on the shell, fans, duct work, between the fins on spray shields and other places which act as traps for accumulations.

In order to remove scale accumulations from air conditioning equipment with solvents satisfactorily, it is necessary not only to find solvent mixtures which will dissolve the scale in the equipment, but also to protect the metals in the equipment during the scale removal.

As air conditioning equipment may contain steel, cast iron, copper, brass, bronze, zinc, solder and other metals which in combination

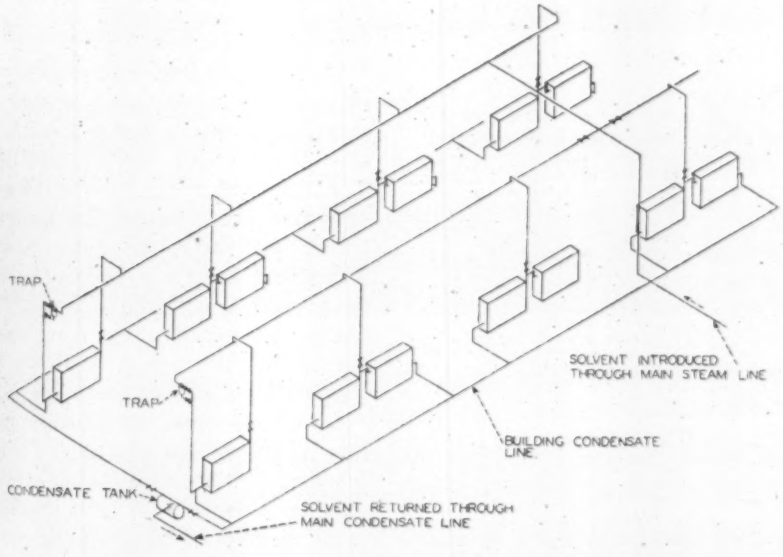


Fig. 3—Hook-up for treating a single building radiator system in one of the seven buildings treated in one operation

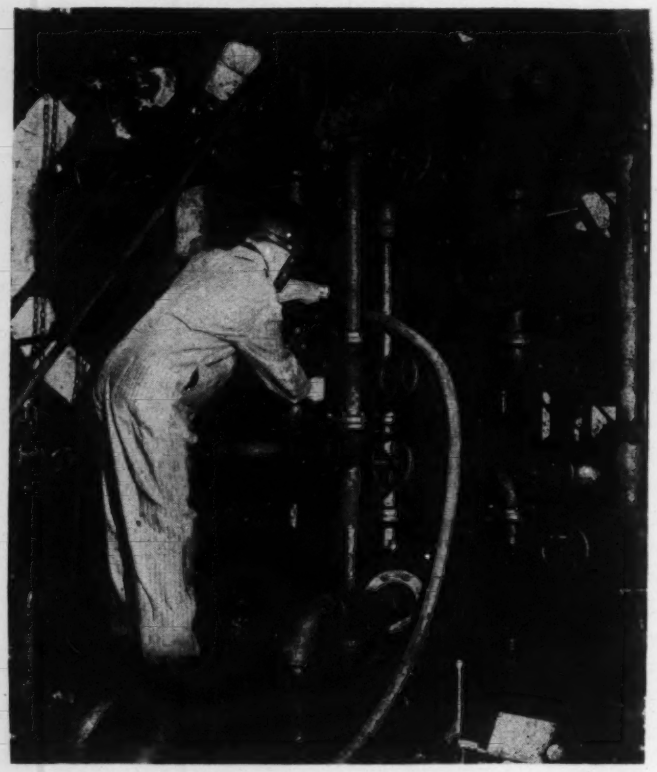


Fig. 5—Chemical cleaning without dismantling of a large and complex condenser unit

may be difficult to protect properly from the corrosive solvent, proper inhibitors are of major importance in cleaning equipment of this type. There are inhibitors which give maximum protection on steel, for example, which may actually accelerate metal loss on brass. Experience and proper testing and control equipment are, therefore, important in chemically removing scale in air conditioning equipment.

In one installation a tube type of air cooler, used to cool the air which in turn cooled 12—1400 hp motors, was chemically cleaned in 8 hours without any dismantling. The existing water input and return lines were used to introduce the solvent. The coolers were 40 ft long, 10 ft high and 3 ft thick and contained thousands of small copper tubes which were scaled up with a carbonate scale and copper oxides and were practically useless before treatment. After treatment the coolers had almost the same heat exchange coefficients as they had when they were first installed. (See Fig. 6.)

The accumulation of scale in the cooling jackets of compressors and large internal combustion water cooled engines is a frequent cause of costly shutdowns with the additional loss of efficiency in plant operation. By solvent cleaning methods scale has been removed successfully in a few hours

Fig. 6—Hook-up for successfully removing scale from tube type air cooling unit 40 ft long and 10 ft high

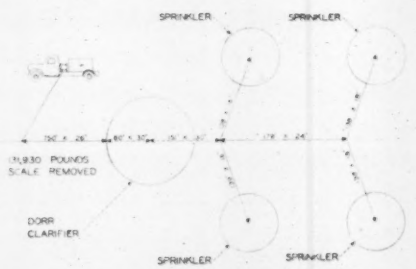


Fig. 7—Underground waste disposal system which was cleaned of scale in less than 24 hours without any dismantling

from the cylinder water jackets and from the water cooled piston rods and water cooled exhaust valves of each of five 1250 hp compressors. The solvent was introduced through the cooling water inlet connections so no dismantling was necessary.

A novel treatment which illustrates the varied applications of chemical solvent cleaning was made in the removal of scale from an underground waste disposal system. The system contained spray nozzles and 1714 ft of 16 to 30 in. pipe, and the whole internal system being well covered with scale. The only practical method of cleaning was the use of solvents as the pipe was buried under large filter beds (see Fig. 7). The scale to be removed was found to contain: 75 per cent iron carbonate, $F_e\ CO_3$; 15 per cent amorphous iron compounds; 10 per cent organic material. In order to clean the system approximately 35,000 gal of solvent were used and the system was back in service within 24 hours. The installation was not disturbed as it was not necessary to dig up any lines. The pumping rate was increased from 11.6 to 14.4 million gallons of water per day.

Cold water supply lines sometimes present a serious problem especially where they are buried, contain many bends and turns, are of different sizes of pipe and where the water supply cannot be interrupted long enough to permit removal of scale from the line.

In order to remove the scale chemically from 800 ft of buried 4 in. wrought iron line which had leaded joints and was located in a railroad yard, a pump truck was attached at each end of the line. The line was then filled with solvent and the solvent was pumped back and forth for four hours. When the line was inspected the scale which originally was 2 in. thick was found to be completely removed. The pump delivery increased from 42 gpm to the original rate of 125 gpm. Since this particular water line was used for the locomotive water supply on a main line of a railroad and as only a very inadequate standby line was available the line could not have been out of use for more than

10 hours for cleaning. Actually it was in operation within 8 hours. The only pipe work performed was the making of solvent pump connections at both ends of the line and connecting four ½ in. pipe vents which were necessary to remove the gas formed in the chemical reaction.

Water wells may be increased in production by the removal of deposits or plugging agents from the well screen or by increasing the permeability of the water bearing formation. Various chemical treatments have been used for rehabilitation of water wells. Some of these produce successful and profitable results while others, due to improper materials or technique being used, result in no improvement. Numerous water wells have been successfully treated with chemicals with satisfactory results. Table 1 illustrates some of the results that followed the acidizing of water wells. Acidizing of water wells, when handled by competent persons, provides a safe and sure method of improving most wells. Inhibitors to protect the steel well equipment and proper auxiliary chemicals must be used if maximum results are to be realized.

A typical water well treatment is illustrated by a treatment made on a well producing from a limestone 1900 ft deep. The treatment was made in two stages, the first stage covering the entire producing section. Before the second stage was made the lower 175 ft of the hole was plugged with a sealing compound material which was applied to the well in a liquid and formed a dependable plug. Several hours later this material returned to its fluid state uncovering the plugged off section. The sealing compound was used to block off the more permeable lower section which had absorbed most of the first solvent pumped into the well. After the seal plug had turned into a semi-solid the solvent was pumped into the less permeable section above the sealed section. Before treatment this well produced 65 gpm with a 150 ft draw down and after treatment the well tested 635 gpm with an 82 ft draw down. This was an increase of approximately 950 per cent.

In many hundreds of steam boilers, from the highest pressure steam generators to the small flash type water tube, small horizontal return tube and vertical fire tube boilers, the chemical scale removal method of cleaning is used with perfect safety to the equipment. The scale removal is almost universally successful and permits return of the equipment to operation in a few hours.

The progress of chemical cleaning during the last five years, due to a great amount of research, has resulted in improved knowledge of basic solvents and auxiliary agents; design of special equipment to transport, blend and pump large quantities of special solvents, and in improved practice in application of cleaning methods.

Chemical cleaning is being effectively used upon condensers, water lines, economizers, superheaters, all types of boilers, stationary—both water tube and fire tube—locomotive and marine; evaporators, condensate lines, hydraulic valve systems, water stills, filters and softeners; blast furnace cooling coils, air conditioning equipment, all types of refining, distilling and food processing equipment, water wells, cooling jackets on internal combustion engines, compressors and other equipment.

Table 1—Results of Water Well Acidizing

Location of Well	Use for Water	Type of Completion	Type of Formation	Acid Used (Gal)	Production (GPM) Before Acid Treatment	Production (GPM) After Acid Treatment	Per Cent Increase
Kansas	Industrial	Open Hole	Sandy Dolomite	3000	154	705	358.
Wisconsin	Domestic	Gravel Packed	Sandstone	5000	850	1250	47.1
Texas	Domestic	Open Hole	Limestone	9000	65	632	872.
Ohio	Industrial	Open Hole	Limestone	1000	200	800	300.
Illinois	Domestic	Screen	Gravel	3000	325	825	154.
Indiana	Domestic	Gravel Packed	Sand	1000	150	400	166.7
Kansas	Domestic	Gravel Packed	Sand	1000	200	800	300.
Illinois	Domestic	Gravel Packed	Gravel	1500	50	250	400.
Ohio	Industrial	Open Hole	Limestone	1000	195	285	46.
Wisconsin	Domestic	Screen	River Gravel	500	375	715	90.7
Illinois	Domestic	Open Hole	Dolomite	2000	133	221	66.

Bibliography

1. Chemical Analysis by X-Ray Diffraction, by J. D. Hanawalt, H. W. Rinn, and L. K. Frevel. (*Industrial and Engineering Chemistry*, Analytical edition, vol. 10, 1938, pp. 457-512.)

2. Chemical Removal of Scale From Compressor Engines, by Guy F. Williams. (*Oil and Gas Journal*, vol. 38, May 2, 1940, pp. 34-36.)

3. Chemical Removal of Scale From Refinery Equipment, by L. W. Lee. (*Refiner and Natural Gasoline Manufacturer*, vol. 19, June 1940, pp. 106-108.)

4. Chemical Removal of Scale From Heat Exchange Equipment, by F. N. Alquist, C. H. Groom, G. F. Williams. (*Transactions of the ASME*, vol. 65, no. 7, October, 1943, pp. 719.)

5. Boiler and Condenser Tube Scale Removed Chemically, by Guy F. Williams. (*Electric Light and Power*, vol. 22, no. 10, October, 1944, pp. 56-59.)

6. Recent Experience With Chemical Removal of Scale From Condenser Tubes, by J. S. Rush and W. S. Jennings. (*Petroleum Refiner*, December, 1944.)

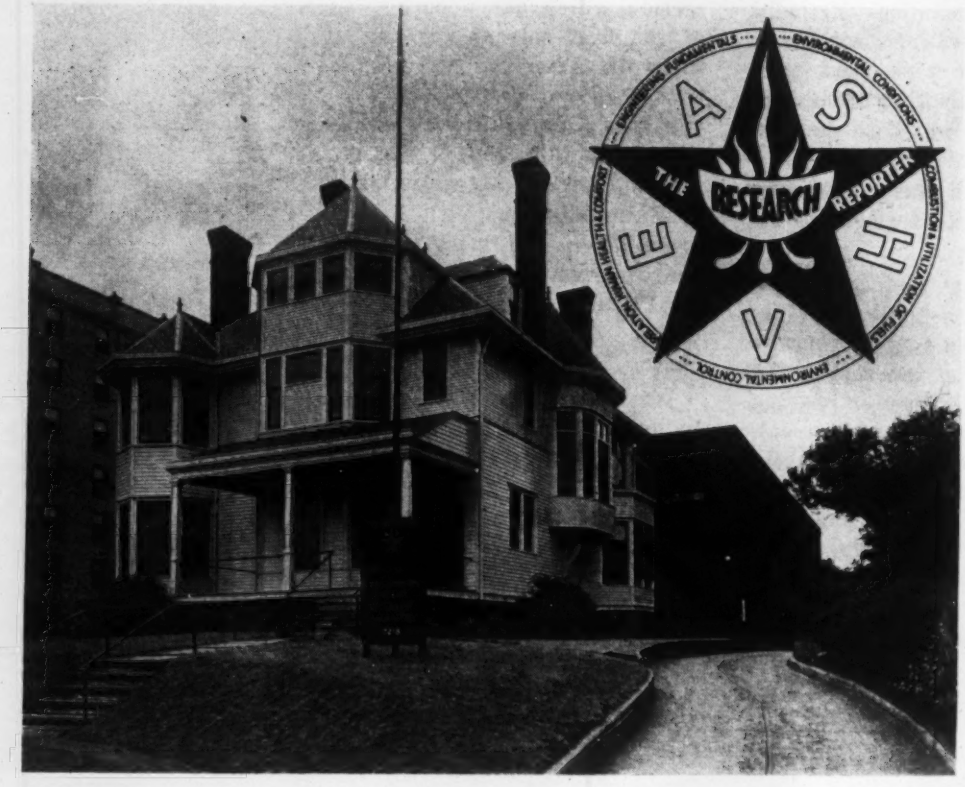
7. Chemical Descaling of a Modern Steam Generator, by M. E. Brines. (*Power Plant Engineer*, July, 1945, vol. 49, no. 7, pp. 90-93.)

W. L. WOODBRIDGE ANNOUNCES NEW CORPORATION

The organization of Radiant Panel Heating, Inc. has been announced by its founder and president, Wm. L. Woodbridge, a member of the ASHVE. The headquarters will be at 3950 Green Lake Rd., Route 2, Walled Lake, Mich.

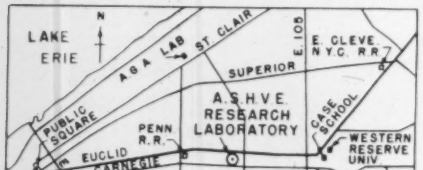
Others in the corporation with Mr. Woodbridge are, Grant Dudley, vice-president, formerly with Ford Motor Co.; Charles McCall, secretary and treasurer, recently discharged from the U. S. Coast Guard, and before the war, employed by Woodbridge Plumbing and Heating Co.; John McCall, until recently a member of the Corps of Engineers in the U. S. Army; and Howard Johnson and Louis Tanguay, both formerly with Ford Motor Co.

Mr. Woodbridge has the distinction of being a pioneer of radiant heating in Oakland County.



OUR NEW LABORATORY

THE Research Program is now in full operation in the new quarters purchased by the Society in March. Located near 71st Street on Euclid Avenue, Cleveland (see map), the Laboratory is easily reached from the Cleveland Terminal and from the East 55th Street station of the Pennsylvania Railroad.



Size of the lot is 86 ft by 580 ft, and the plot plan indicates the location of the office and laboratory space. A small structure to house equipment for studies on solar radiation is now being erected on the open land at the rear of the building.

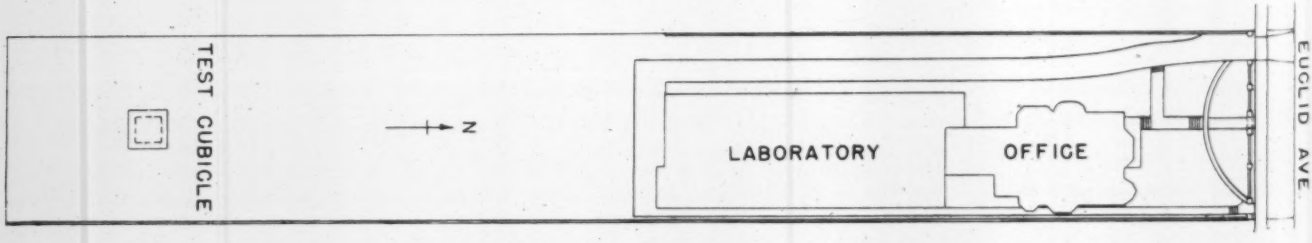
Structural repairs and alterations to both laboratory and office space have been completed. Excellent facilities are available for committee meetings and group conferences.

The staff is ready to welcome society members and representatives of the industry to discuss the programs now under way and those planned to meet the needs of the industry in the future.

COOPERATIVE CONTRACTS

The Committee on Research met during the Semi-Annual Meeting of the Society on board the *S. S. Quebec*. In addition to reviewing the research projects currently in progress at the new Laboratory, the committee approved the renewal of Cooperative Research Contracts for 1946-47 with the following institutions:

Case School of Applied Science, Cleveland, Ohio
University of Illinois (Medical School), Chicago, Ill.
University of Illinois (Engineering Experiment Station), Urbana, Ill.
State University of Iowa, Iowa City, Ia.
Kansas State College, Manhattan, Kans.
University of Toronto, Toronto, Ont.



STUDIES ON "ENTERING AND LEAVING SHOCK" TO BE CONTINUED AT UNIVERSITY OF ILLINOIS MEDICAL SCHOOL

No aspect of summer air conditioning has received more public attention than the so-called *shock effect* on entering a cooled enclosure from a hot outside and on returning to the outside from a cooled interior.

Both sensory reactions and physiological adjustments enter into the problem, which also has an important economic angle.

The Committee on Research has arranged with the College of Medicine, University of Illinois, Chicago, Ill., to continue the studies commenced in 1940 but suspended early in 1942 on account of the war. The investigations, which will deal with the physiological adjustment of human beings to rapid changes in atmospheric environment, will be under the immediate direction of Dr. Robert W. Keeton, head of the Department of Medicine, and under the general supervision of the Society's Technical Advisory Committee on Physiological Research, Dr. C.-E. A. Winslow, Chairman.

Tests will be made with both male and female subjects and will cover moving from a hot environment of around 90 deg ET to comfort conditions ranging from about 69 to 73 deg ET. The reverse will also be studied and physiological adjustments determined when persons enter a hot environment from a comfortable one. The effects of different types of clothing will receive particular attention.

Data of great significance in problems of comfort cooling are expected from these studies.

BRITISH NAVY ADOPTS EFFECTIVE TEMPERATURE SCALE

The report *Environmental Warmth and Its Measurement* prepared by Dr. Thomas Bedford, Medical Research Council, London, and a member of the Society's Technical Advisory Committee on Physiological Research, describes the use of the effective temperature scale aboard ships of the Royal Navy. The report states:

"For most practical purposes, and at any rate until the warmth of the environment approaches the endurable limit, effective temperature remains a reliable index of warmth. Recent studies suggest that at temperatures near the endurable limit the effective temperature scale makes too much allowance for dry bulb temperature, and that wet bulb temperature may be a better index than the present effective temperature scale, but further research is needed to settle this point."

To make allowances for radiant heat, the British Navy has provisionally adopted an index called *The Corrected Effective Temperature* in which the reading of the Globe thermometer is used instead of the dry bulb thermometer.

The report also points out that readings of the silvered Kata thermometer and the wet Kata thermometer are no longer considered suitable as an index of the warmth of an environment.

Courtesy of British Information Services

H. M. S. "Howe"

(Left to right) F. A. Hamlet, A. B. Madden, Alfred J. Offner, T. H. Worthington, His Worship the Mayor of Montreal, S. W. Salter, C. A. Booth and Leo Garneau

Semi-Annual Meeting in Canada

OVER 400 enthusiastic members and guests of the ASHVE gathered in Montreal for the Semi-Annual meeting, June 10-12, 1946. Members began to arrive at the Mount Royal Hotel on Saturday and Sunday, June 8 and 9, in order to visit the historic and scenic attractions of Montreal. All arrangements for the meeting were in charge of the Montreal Chapter members who were on hand to greet the visitors.

While Committee and Council members attended business sessions on Sunday and Monday morning, others drove to the top of Mount Royal for a view of the city and of the St. Lawrence; visited churches, cathedrals, and shrines; or took the occasion to do some interesting shopping.

The registration on Monday morning, June 10, at the Mount Royal Hotel was followed by a Welcome Luncheon in the Jacques Cartier Room at 12:15 p. m. F. A. Hamlet of Montreal Chapter was toastmaster and introduced the national Society officers, Montreal Chapter officers and members of the Committe on Arrangements. In response to the welcome expressed by A. B. Madden, Chapter president, Pres. A. J. Offner, New York, N. Y., replied as follows:

Thank you very much, President Madden, for your cordial welcome to Canada. While we have been in Canada before, it is the first time that we have had the experience and pleasure of holding a meeting with Montreal as the host Chapter. Your Chapter has the unique distinction of being the first Chapter to arrange for a meeting of the Society aboard ship, and we are looking forward with great anticipation and interest to this novel arrangement. We will enjoy seeing the fascinating sights of Montreal; we look forward to seeing the historical city of Quebec, and the scenic beauties of the St. Lawrence and the Saguenay Rivers.

Personally, I feel quite at home in Montreal and, speaking for the membership as a whole, I know that we will anticipate a fine time at the 1946 Semi-Annual Meeting.

The principal speaker at the luncheon was His Worship, the Mayor of Montreal, whose hearty welcome and remarks were greatly appreciated.

First Session—Monday, June 10, at 2:30 p. m.

The first technical session was called to order by President Offner in the Jacques Cartier Room at 2:30 p. m.

First Vice-Pres. B. M. Woods, Berkeley, Calif., referred to the proposal made at the Annual Meeting in January, that the Council be authorized to invest such portion of the Society Endowment Fund as may be advisable for the purchase of real property for Society use and suggested that favorable action be taken.

President Offner stated that, since three of the four technical papers to be presented at the session were prepared from Society research or cooperative research, he would request Cyril Tasker, Cleveland, Ohio, Director of Research, to preside at the meeting and to introduce the authors and subjects.

Mr. Tasker remarked that two papers had been prepared by the Research Laboratory staff, one by Case School of Applied Science from cooperative research, and one by the Division of Industrial Hygiene of New York State Department of Labor, which could also be classified as a research organization.

G. V. Parmelee, Cleveland, Ohio, presented the paper Forced Convection Heat Transfer Coefficients Along a Flat Surface, by Mr. Parmelee and R. G. Huebscher (published in May 1946 JOURNAL SECTION,

Heating, Piping & Air Conditioning), which was a summary of a complete report of work carried out under the direction of the Technical Advisory Committee on Glass. Discussions of the paper were as follows:

C. M. Ashley, Syracuse, N. Y., stated that the paper was of considerable significance because it extended the work of previous investigators and formed a basis for the addition of further variables. He inquired about the significance of the α (alpha) factor and asked also if there was an explanation for the position of a certain group of test points below the curve in Fig. 4.

S. H. Downs, Kalamazoo, Mich., asked why the flow changed from turbulent to laminar when the plate was reversed in position. He also suggested that since turbulent flow and *large scale* turbulence were mentioned, it might be advisable to invent a new term for the latter.

The author defined α as the ratio of the heat transfer coefficient of the test area to the average coefficient for the test area plus the area in front of it. No explanation had been found for the location of the test points below the curve. Change of flow from turbulent to laminar by the reversal of the plate appeared to be due to the shape of the strut used to support the plate; possibly due to the change in the radius of the strut.

L. G. Seigel, Case School of Applied Science, Cleveland, Ohio, presented the paper, The Effect of Turbulence Promoters on Heat Transfer Coefficients for Water Flowing in Horizontal Tubes, by L. G. Seigel (published in June 1946 JOURNAL SECTION, *Heating, Piping & Air Conditioning*). He stated that the paper was the result of work instigated by the Bureau of Ships of the Navy Department, which desired to obtain a minimum weight and size for air conditioning equipment on shipboard. This investigation pertained to the use of turbulence promoters in $\frac{5}{8}$ in. O. D. tubes through which water was circulated as a cooling medium. Discussion of Professor Seigel's paper follows:

Mr. Ashley remarked that the work reported in the paper had added to the knowledge of heat transfer in this slightly explored field. He pointed out, however, that it had generally been found more desirable to obtain increase of heat transfer in coils with less loss in pressure by increasing the velocity of the water in the tubes by recircuiting. For this reason and also because of the possibility of fouling of tubes containing turbulence promoters, they were never used in practice except in special applications.

Mr. Ashley asked whether the author would interpret the test results in terms of heat transfer versus pressure drop and also whether an explanation could be given for the scattered location of test points.

W. R. Heath, Buffalo, N. Y., inquired whether an attempt had been made to increase the total heat transmission by attaching the turbulence promoters to the tube in order to increase the internal surface. He also asked whether such tests were being contemplated, if not already made.

H. J. Ryan, New York, N. Y., questioned whether increase in pressure drop due to the use of turbulence promoters might not be out of proportion to the gain in heat transfer obtained.

G. L. Tuve, Cleveland, Ohio, cited an experience in which a 30 per cent increase of cooling effect was obtained in a test room by bending of the cooling coil tubing into a spiral shape. He invited correspondence relating to the use of turbulence promoters because he stated much research work was now under way on the use of turbulators in refrigerant evaporator coils.

Professor Seigel stated that the cause of scattering of points had not been found, but that a similar condition had been reported in the results of tests using oil as a cooling medium, which were reported in the first edition of *Heat Transmission* by William H. McAdams.

Referring to Mr. Heath's question, the author stated that the turbulence promoters fitted snugly in the tubes but were not attached thereto.

Before introducing the next paper, Mr. Tasker referred to the successful meeting on industrial ventilation which was held in Detroit and sponsored by the Committee on Research. He stated that as a result of the interest developed at that meeting Dr. A. D. Brandt, Sanitary Engineer, U. S. Public Health Service, had been assigned to the ASHVE Research Laboratory for work on industrial ventilation problems. Although Dr. Brandt would not be available to continue his work because of his resignation from the USPHS, he would nevertheless continue to assist the Laboratory with his counsel.

Dr. Brandt presented a summary of his paper Energy Losses at Suction Hoods, which he prepared with Russell J. Steffy as co-author (complete paper and discussions to be published in JOURNAL SECTION, *Heating, Piping & Air Conditioning.*)

A. C. Stern, New York, N. Y., chief engineer, Division of Industrial Hygiene, New York State Department of Labor, presented the paper Characteristics of Unit Dust Collectors, by A. C. Stern, Jack Baliff, A. E. Perina, Robert Crowley, Benjamin Feiner, and A. A. Urbano (published in May 1946 JOURNAL SECTION, *Heating, Piping &*

On the Saguenay

Pres. Alfred J. Offner

Mr. and Mrs. A. B. Madden

Mrs. G. Lorne Wiggs, Mrs. F. W. Hutchinson, C. M. Burnam, Jr., Chicago, and Kay Hutchinson

Mrs. Alfred J. Offner

G. L. Ballantyne, Miss Dorothy Mildner and Mrs. Ballantyne

Air Conditioning).

Mr. Stern stated that, in addition to describing methods of testing dust collectors, the paper showed that most of the units developed approximately 50 per cent of the manufacturer's ratings. Discussions of the paper were as follows:

J. M. Kane, Louisville, Ky. (Written): The comprehensive test data presented by Mr. Stern and his associates indicate that unit dust collector designs using an effective primary dust collector and a high efficiency viscous filter as a final cleaner permit visible and objectionable concentrations of dust to escape to the workroom.

It should be noted that probably 90 per cent of all unit dust collectors are installed to remove dust from metallic grinding, polishing or buffing stands; from tool room machines such as surface, cutter, tool and hob grinders; or from portable or flexible shaft grinders. The dust collected from this group of operations will have distinctly different particle size distribution and higher specific gravity than tumbling mill dust used to secure the test data. Visible escapement of dust is certainly not typical of collector units in this group on such applications and obviously would not be tolerated by users if such visible escapement were existent in actual practice.

While it is agreed that the efficiency of viscous filters on fine particles is lower than on fabric filters of cloth, felt, or similar media, the advantages of high dust holding capacity with slow rise in resistance of the viscous filters should not be overlooked. It is extremely difficult to obtain vibration of fabric filters every 8 hours especially of the small unit collector type. Failure of such maintenance will result in extreme reduction in exhaust volume and will allow dispersion of increasing quantities of dust to the workroom because of insufficient air flow at the exhaust hood.

From the above comments it appears that the rating procedure based on tumbling mill dust or equal is too severe for an estimated 90 per cent of unit dust collector applications and that dust counts on effluent air would be greatly reduced had test conditions reproduced dust loadings typical of that group.

It should also be questioned whether air cleanliness of three mppcf (million parts per cubic foot) for effluent air exhausting nontoxic metallic dust should be required, realizing that 5 mppcf is generally accepted as safe limits for 100 per cent free silica, and noting further that unit dust collectors are only applicable to exhaust systems of small air volume. The proposed standards would prevent the installation of a unit collector having a dust count of 5 mppcf (assuming ambient count is 2 mppcf) for a two wheel grinding stand requiring an exhaust volume of 1000 cfm unless the workroom were 250x40x10 ft and further unless this unit dust collector were the only collector in that area.

R. S. Farr, Los Angeles, Calif., reported some tests in dust collecting in which he found that a precleaner and a viscous impingement filter used together operated with less efficiency than that obtained by the filter when used alone. Precleaners, he said, take out the heavy particles and filters remove the light ones but filters taking out both heavy and light particles were more efficient than the combination.

Mr. Tasker referred to the Society's vital interest in the subject of air cleaning and mentioned that as a result of the consideration given the subject at the last meeting of the TAC on Air Cleaning the Research Laboratory would have a full time research engineer on air cleaning problems. Arrangements were being made to obtain financial assistance from the air filter industry and it was expected that information obtained would lead to development of a standard code for testing air cleaning devices.

Dr. Brandt pointed out that there are three types of air cleaning devices: (1) filters or cleaners which remove soot and dust from ventilation systems in office and public buildings, such as stores, theaters, etc.; (2) filters or collectors used to remove relatively high concentrations of atmospheric contaminants from air handled by industrial exhaust systems; and (3) cleaners used on intakes of compressors and other types of machines.

He stated that the TAC on Air Cleaning appeared to be interested only in the first type, whereas real interest should be shown in at least the first two types mentioned. Lack of progress to date in regard to the second group was shown by the fact that Mr. Stern had to devise testing methods for the air cleaners investigated.

R. S. Dill, Washington, D. C., stated that the air filter industry had been stalled for 15 years on the matter of a standard dust for testing air cleaners. He proposed that filters be tested with a series of dusts and be classified according to the size of dust which the filter would collect. The TAC on Air Cleaning, he said, is interested in industrial dust catchers as well as in air filters.

L. T. Avery, Cleveland, Ohio, suggested that as an air cleaner user he was interested in a rating which the user could depend upon for a continuous performance. Rating in terms of a clean air cleaner seemed meaningless.

W. H. Carrier, Syracuse, N. Y., referred to the importance of considering the type of dust and the weight per micron as well as the size. He pointed out that there is a great difference in the type of cleaner required, for example, for relatively heavy metallic dusts and that required for fine cotton or lint dusts. It is necessary, he said, to study the subject broadly in order to decide upon the different types of dust which should be considered as test dusts.

Mr. Farr mentioned that the TAC on Air Cleaning was considering the questions raised by both Mr. Avery and Mr. Carrier. He stated a standardized test method was necessary in order to evaluate the effect of dust particle size and density.

S. H. Downs, Kalamazoo, Mich., remarked that the discussions of rating usually referred to the rating of complete systems, whereas catalog ratings of air cleaners referred to the performance of an individual part of the system only. The purchaser of a cleaner installs it in a system and then the system design has an effect upon the performance.

The author pointed out that it had been necessary to devise a test method for the air cleaners in order to be able to tell inspectors and purchasers what to expect in regard to air cleaner performance.

Referring to Mr. Kane's statement that 90 per cent of the installed cleaners were dealing with dusts which were easier to handle than the dust used in the test, the author stated that, in view of the absence of any control over buyer, purchaser, or method of rating, it was preferable to have a test dust representing 25 per cent of the difficult cases rather than one representing 75 per cent of the easier ones.

Referring to Mr. Downs' remark, the author stated that unit dust collectors were usually installed adjacent to the source of contamination and therefore were not greatly affected by duct connections and hoods.

The author stated that rating of cleaners with reference to size of particles separated was in use for rating equipment designed to remove cinder and fly ash from flue gases.

Second Vice-Pres. G. L. Tuve then took charge of the meeting and announced that the registration at 5:00 p. m. was 325 members and guests. Members were informed that the *S. S. Quebec* would sail at 7:45 p. m. daylight saving time and that the second session would be held aboard the boat.

The meeting was adjourned at 5:20 p. m.

Second Session—Tuesday, June 11, at 9:30 a.m.

The meeting was called to order in the music room of the *S. S. Quebec* by First Vice-Pres. B. M. Woods, Berkeley, Calif., who introduced G. Lorne Wiggs, a member of Montreal Chapter, who presented his paper Air Conditioning a Canadian Windowless Textile Mill (published in July 1946 JOURNAL SECTION, *Heating, Piping & Air Conditioning*). Discussions of the paper were as follows:

Cyril Tasker, Cleveland, Ohio, asked whether dry bulb temperature was of any great significance outside of its effect on the relative humidity and whether relative humidity was not the more important factor. In view of the small number of employees working in a textile mill it seemed that the human load would be quite a small part of the total.

L. T. Avery, Cleveland, Ohio, remarked that in order to hold the relative humidity constant it would be necessary to hold the temperature constant. Mr. Avery also inquired about the construction of the air distribution box with regard to position of air outlets.

H. E. Ziel, Detroit, Mich., inquired whether the fan room and first floor side walls and roof were of the same construction. He also asked whether a closed type exhaust and recirculating system had been considered in order to reduce the need for insulating the fan room walls.

R. S. Dill, Washington, D. C., asked what type of air cleaners were used in the recirculating air stream.

Replying to the discussions the author stated that mill operators desired constant relative humidity, but that for production of cotton goods he was not certain whether relative humidity or absolute humidity was most important. Temperatures seemed to be of secondary importance. While an operator usually tended 100 spindles, the machines shown in the mill described would enable an operator to tend 500 or 600 spindles.

The air distribution boxes were designed for streamlined flow from the units into the box and had grille outlets on both sides equipped with deflectors to direct the air upward or downward.

Replying to Mr. Ziel, the author stated that the insulation in the fan room and in the first floor rooms was the same in regard to heat loss, but that the construction was different.

Air cleaners used in the plant consisted of wire mesh in the air outlets in the rooms, filters on the air conditioning units, also an air washer. A central vacuum cleaner system was used to pick up the bulk of the lint.

First Vice-President Woods expressed interest in the fact that water could be used for cooling purposes and wasted, whereas in California water would be too scarce for such a purpose.

C. O. Mackey, Ithaca, N. Y., presented the paper, The Sol-Air Thermometer—A New Instrument, which he prepared with L. T. Wright, Jr., as co-author. Comments on the paper were as follows:

C. F. Kayan, New York, N. Y., congratulated the authors on developing an instrument which gave promise of much future use. He inquired whether any temperature measurements were made at the core of the instrument and also asked how the outside surface coefficients were determined for different air velocities.

C. M. Ashley, Syracuse, N. Y., remarked that the paper was an excellent piece of work and described an instrument for which many valuable uses could be found. Practical problems to be worked out in establishing the accuracy of the instrument were determination of the effect of size of instrument and wind direction. He pointed out that it might not be sufficient to have a larger instrument, but that it also might be necessary to consider a suggested check of the instrument which would be a comparison of readings of the instrument with readings taken on insulated panels of considerable size placed on the sides of a building. Mr. Ashley expressed the hope that accumulation of readings taken with the instrument would make it possible to combine the effects of sunlight, radiation, outside temperature, and wind velocity, and to correlate these with outside wet and dry bulb temperature.

Second Vice-President Tuve, inquired whether any application of the instru-

Mr. and Mrs. J. D. Ross

Miss Elaine Allen, Kansas City

Mrs. W. T. Jones, A. E. Watts and A. M. Peart

L. T. Avery

Lee P. Hynes, E. E. Wells, Mrs. Hynes and Mrs. R. F. Connell

ment had been made to determine emissivity.

Mr. Avery asked whether a modification of the sol-air thermometer would make it adaptable for determining the combined effect of temperature, radiation, air motion, and humidity in the environment of industrial workers.

J. N. Livermore, Detroit, Mich., asked how important it was to have a material of low specific heat and small thermal lag on the surface of the sol-air thermometer and also whether thin pieces of a material of high specific heat would interfere with the taking of proper readings. He asked whether it was practicable to obtain a surface layer of brick and mortar thin enough for test purpose.

Mr. Dill remarked that, since the problem was to secure a mathematical relation of the indication of the sol-air thermometer to the heat gain of buildings, the ultimate form of the instrument was not of importance as long as it were standard.

L. T. Wright, Jr., Ithaca, N. Y., presented the paper Periodic Heat Flow—Composite Walls and Roofs, by C. O. Mackey and L. T. Wright, Jr. (published in June 1946 JOURNAL SECTION, *Heating, Piping & Air Conditioning*). The following discussions were presented:

Professor Mackey stated that the exact analytical solutions for the two and three layer walls mentioned in the paper would be included with the paper when published in the TRANSACTIONS. This additional material would also show the effect of the order of assembly of the material layers in the walls and would include the effect of interchanging inside and outside layers. A newer method of obtaining an equivalent simple wall which had been developed after the paper had been completed would also be included in the TRANSACTIONS.

In responding to the discussions the author stated that no measurements of temperature were made at the core of the instrument. The sol-air thermometer was presented as an idea which it was hoped others would study. Wind velocity was not measured, but the sol-air temperature was influenced by wind velocity.

With the sol-air thermometer exposed to a clear night sky it was found that horizontal top surface was 10 deg below air temperature and the sides were about 5 deg below.

Mr. Tasker paid tribute to the excellent work Professor Mackey had done for the Society on heat flow and cooling load determinations.

Mr. Ashley referred to the great value of the several papers on sol-air temperature and periodic heat flow which the authors had presented to the Society. One important point established in the papers has been the small importance of the sunlight radiation upon the total heat load. A result of the studies reported has been the establishment of an orderly procedure in solving periodic heat flow problems and, in addition, the work has shown many inconsistencies in experimental data which have been used to date. The papers have emphasized the need for better data on conductivity, density, and specific heat of material, film coefficients, and sunlight radiation, and have stimulated research activity on these subjects. Mr. Ashley suggested the desirability of presenting the data in a form more readily usable by the estimating engineer.

Professor Mackey stated that a simplified presentation of the data had been given to the TAC on Cooling Load and it was hoped that simple tables of desired accuracy could be provided.

The next paper, Heat Losses Through Wetted Walls, was presented by the author, E. C. Willey, Corvallis, Ore. (published in June 1946 JOURNAL SECTION, *Heating, Piping & Air Conditioning*). Discussions of the paper were as follows:

W. H. Carrier, Syracuse, N. Y., inquired whether any attempt was made to apply a correction for different outdoor vapor pressures.

Prof. C. F. Kayan, New York, asked whether the outside film coefficients had been determined for the test conditions.

Mr. Tasker spoke of the obstacles Professor Willey had overcome in completing the work reported in the paper.

Professor Willey stated that no work was done in determining film coefficients as the investigation covered only the determination of overall coefficients.

After an expression of thanks to the author and discussers and a statement that the session had been highly successful and very enjoyable, First Vice-President Woods announced that the meeting was adjourned at 11:45 a.m.

Third Session—Wednesday, June 12, at 9:30 a.m.

The third technical session which was held in the music room of the *S. S. Quebec* was called to order by Second Vice-Pres. G. L. Tuve at 9:30 a.m., June 12.

The paper, A Rational Basis for Solar Heating Analysis, by F. W. Hutchinson and W. P. Chapman, was presented by Professor Hutchinson (published in the July 1946 JOURNAL SECTION, *Heating, Piping & Air Conditioning*). Professor Hutchinson pointed out that the object of the study being made was to investigate solar heating under ideal conditions in actual houses built for test purpose in order to learn the advantages and disadvantages of solar heating. Discussions of the paper were as follows:

Second Vice-President Tuve mentioned that the Society received many requests for information on radiant heating and solar heating and that the paper pointed out various steps required in a research program relating to the subjects.

G. Lorne Wiggs, Montreal, asked whether the two panes of glass forming the air space were hermetically sealed and whether the graphical solution could be applied to

ouble glass whether air was contained between the panes r not.

C. F. Kayan, New York, N. Y., asked for the authors' omments on the day and night temperatures obtained n the solar and non-solar houses.

Professor Mackey expressed the thought that the study eported was very important. He asked how the authors btained the solar and sky radiation on a vertical surface, hat is whether it was obtained from the Weather Bureau r calculated as if the radiation were all beamed and then orrected as beamed radiation by trigonometrical means or vertical surfaces. Other questions asked were whether imilar calculations were to be made for other than the rincipal orientation, since obviously there might be opti- num orientation such as 15 deg west of south. Professor Mackey also asked whether the charts applied to both ouble and single glass construction.

W. E. Heibel, New York, N. Y., inquired whether the ype of glass used had any effect in filtering the solar ays and whether some types of glass were better than thers.

Brig. Gen. W. A. Danielson, Memphis, Tenn., pointed out hat in living in a solar type house he had found it de- irable to draw curtains at night to prevent heat loss.

L. P. Hynes, Philadelphia, Pa., asked whether any tests were made using glass in an inclined position such as found in greenhouses.

Replying to the discussions, Professor Hutchinson stated that the graphical solution applied regardless of the gas or air contained between the panes of glass, provided it did not contain large quantities of CO_2 or water vapor. During the night the temperature in the solar house was lower than in the non-solar type. During the day there was a rise in temperature in the solar house even when there was no sunshine. It was also of interest that the temperature of the non-solar house also exceeded the outside temperatures, thereby showing that all houses re- ceive some solar heat.

Referring to Professor Mackey's questions, the author stated that the solar intensity curve included all forms of radiation except sky radiation. Allowance was made for sky radiation insofar as it represented energy transmitted through windows.

The author mentioned that orientation was recognized as of great importance and was to be considered in further ex- periments.

Answering Mr. Heibel's questions, Professor Hutchinson pointed out that in summer it is desirable that glass trans- mit a minimum of heat and a maximum of light, but that in winter for solar heating purpose any clear glass would be adequate. Solar heat transmission into the building, he said, was independent of outside temperature, but the heat loss from the room through the windows to the outside would increase with a decrease of outside tem- perature.

No tests of glass in an inclined position had been planned under the present appropriation of funds.

In referrring to General Danielson's remark, the author stated that the tests showed results for all of the solar energy that could pass into the house, but that obviously results would be different in a house where drapes were closed at night to keep heat in and where they might also be closed during part of the day.

Second Vice-President Tuve announced that New York Chapter and Pittsburgh Chapter had contributed $875 toward payment of the mortgage on the new Re- search Laboratory.

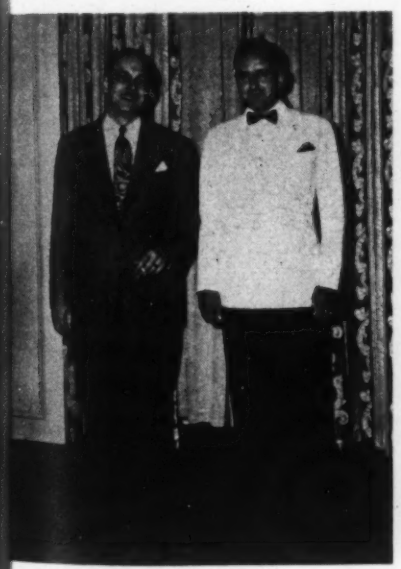
First Vice-President Woods announced that after further consideration by the Finance Committee and the Council it was found desirable to reconsider the action taken at the first technical session regarding the Endowment Fund and a motion to reconsider the action was voted, after which the original motion was with- drawn.

C. C. Wright, State College, Pa., presented the paper Hold-Fire Controls for Bituminous Coal Stokers, which he prepared with T. S. Spicer and H. A. Baumann as co-authors (published in this issue, see pp. 101-107). Discussions of the paper were as follows:

R. A. Sherman, Columbus, Ohio, remarked that while the time-lapse control might be wrong in principle it was simple and had worked satisfactorily with a large number of types of coal. He agreed that because of the over-run of temperature experienced in mild weather, stokers em- ploying such controls were not as efficient as other fur- naces using fuels which did not require hold-fire devices. He inquired whether the author had come to a conclusion regarding the average amount of fuel that might be saved per hour by a firebox temperature control and also what the maximum allowable fuel consumption for a hold-fire operation should be. These items would be of value in judging stoker performance and stoker fuels.

R. A. Baker, Syracuse, N. Y., inquired whether there was on the market a satisfactory temperature operated hold-fire control.

W. H. Carrier, Syracuse, N. Y., reported a satisfactory six-year continuous operation of a time-lapse type of control on an anthracite type of stoker on which the



J. E. Haines and Prof. F. W. Hutchinson

Mr. and Mrs. A. E. Horsburgh

Mr. and Mrs. J. B. Dykes

EN ROUTE TO MONTREAL!

" . . . that's interesting, I'm also on my way to the ASHVE Meeting in Montreal."

"My name is *Close*. I'm from Chicago."

"My name is *Farr*. I'm from Los Angeles."

The above is an extract from a conversation which took place on the train en route from Chicago to Montreal between two of the Society Members, Paul D. Close, Chicago, and Richard S. Farr, Los Angeles.

Leaving the Capes

original adjustment had not needed any change.

General Danielson remarked that the time-lapse type of control had worked very satisfactorily in a stoker installation burning anthracite on a hot water installation equipped for summer-winter hot water supply. The boiler thermostat maintained a fire with a water temperature just below 100 F.

Professor Wright referrred to Mr. Sherman's comments and stated that for a home installation the hold-fire rate to take care of the heat loss from the service water tank should be about one-half pound of coal per hour, whereas the lowest rate obtainable by means of the time-lapse control was 2.3 lb per hour, which was about what would be normal for winter operation. The temperature type of control had operated with the same type of coal at one-half pound per hour on a clinkering stoker and at a rate of 0.36 lb per hour with an ash removal type of stoker. While samples of the temperature type of control were in field operation, durability had not yet been determined by operation at a sufficiently long period. Three control manufacturers were working on production of types of control employing the principle described.

Referring to the remarks of General Danielson and Mr. Carrier, the author stated that, while operation with anthracite would be satisfactory with time lapse controls, operation with bituminous coal required a temperature type of control.

Dr. C.-E. A. Winslow presented the paper on The Influence of an Interior Coating of Aluminum Paper on Internal Thermal Conditions and Heat Economy, by R. J. Lorenzi, L. P. Herrington, and C.-E. A. Winslow. Discussions of the paper were as follows:

W. H. Carrier, Syracuse, N. Y., complimented the authors upon the excellence of the paper and asked whether the effective temperature had been evaluated with and without the aluminum coating on the walls. He spoke of the radiant heat transferred between walls and thermometers or thermocouples and, therefore, believed it was important to know how the temperatures were obtained and what the effective temperatures were.

Second Vice-President Tuve stated that too little attention had been given to the emissivity of brick used on both inside and outside surfaces.

L. E. Seeley, Durham, N. H., remarked that as there were three or four walls the saving reported by lowering of night temperatures might be higher than would normally be obtained in a residence.

J. W. Miller, Lansing, Mich., asked whether the information in the paper could be used in computing the heat loss of a construction employing thin inside and outside aluminum surfaces.

Dr. Winslow, speaking for the authors, stated that temperatures reported were operative temperatures which showed the net effect of radiation and convection. Referring to Dean Seeley's comments he stated that the savings reported applied to a two-room one-story building and would be much less in a large building which would also have a much greater storage capacity.

Surface coefficients were found to check values in THE GUIDE of the Society and the results of tests would indicate no change in the present method of computing overall air to air heat transfer coefficients.

Vice-President Tuve announced that the resolutions usually presented at the last technical session would be presented at the banquet at the Chateau Frontenac.

The last technical session was adjourned at 11:25 a.m.

The photographs used were furnished through the courtesy of W. G. Hole, manager, Air Filter Div., Darling Bros., Ltd.; C. A. Booth, sales engineer, Fiberglas Canada, Ltd.; G. Lorne Wiggs, consulting engineer, G. Lorne Wiggs and Co., of Montreal; D. M. Allen, owner, D. M. Allen Co., Kansas City, Mo., and L. T. Avery, president, Avery Engineering Co., Cleveland, Ohio.

The first land and sea meeting of the Society provided

Mrs. L. T. Avery, Mrs. C. E. Price and Mr. Price (Dean L. E. Seeley, G. B. Supple and son at right in rear)

Enjoying the view of the Capes

an opportunity to combine sightseeing in a neighboring country with pleasant relaxation aboard the *S. S. Quebec*, while viewing the interesting landscape along the St. Lawrence River and watching the rocky domes and cliffs lining the Saguenay River, the deepest river in the world. The popularity of this type of summer meeting was shown by the large number of ladies accompanying the members.

Sightseeing tours and visits to churches and informal gatherings of friends provided the entertainment features for Sunday, June 9. More sightseeing and shopping trips were enjoyed by the ladies on Monday, both before and after the Welcome Luncheon.

Immediately after the Monday technical session members and guests boarded the *S. S. Quebec*, promptly filled the dining room for the first meal afloat, and then proceeded to become comfortably settled on deck to watch the scenery. Music for dancing and entertainment were provided in the music room until 12:00 o'clock each evening.

In the afternoons the music room was reconverted into a lounge where concert music was provided by the ship's orchestra and where members and guests had an opportunity for conversation and discussion. A particular advantage of the cruise, since the ship was occupied almost completely by the ASHVE, was that it gave families of members from all parts of the country an opportunity to become well acquainted in the relaxing atmosphere of the ship.

On Tuesday afternoon when the *S. S. Quebec* stopped at Murray Bay, many guests visited the Manoir Richelieu via carriage and bus, although a drenching rain prevented the scheduled sports events which had been planned by the committee. Visitors to the Manoir Richelieu brought back interesting purchases of Canadian handiwork.

On Tuesday afternoon while the ladies inspected the ship's galley, members of the Society accepted the invitation to inspect the engine rooms.

On Tuesday evening after a brief stop at Tadoussac, the *S. S. Quebec* entered the fjords of the Saguenay and, although the sky was clouded at the start, the moon came out about 10:00 p.m. thereby permitting the guests to enjoy the round rocky domes and capes in the moonlight. The ship arrived at Bagotville, the head of navigation for ocean going ships, during the night.

Wednesday morning dawned with a cloudless sky, giving many members an opportunity to watch the sunrise over the Laurentian Mountains. Later as the ship passed the capes of the Saguenay on its return voyage, the ship's engines were stopped to permit taking of pictures and for enjoyment of the beauty of the thousand foot cliffs which seemed only a few feet in distance from the ship.

A stop at Tadoussac permitted members to visit the oldest fur trading post in North America.

Banquet

The *S. S. Quebec* docked at Quebec at 7:30 p.m. and members and guests had a brief view of a part of the city as they were taken by bus to the Chateau Frontenac for the semi-annual banquet. F. A. Hamlet, Montreal, was toastmaster at the banquet at which the firm friendship of Canada and the United States was frequently mentioned by all speakers.

Special features of the banquet were speeches by Monsieur M. Viau, representing His Worship the Mayor of Quebec, Lucien Borne, and the Honorable Paul Balyou, Minister of Trade and Commerce, who represented the Prime Minister of Quebec Province.

Responses to the fine sentiments expressed by the Canadian speakers were given by President Offner and President Madden of Montreal Chapter.

Eight past presidents of the Society were present: M. F. Blankin, Philadelphia, Pa.; W. H. Carrier, Syracuse, N. Y.; S. H. Downs, Kalamazoo, Mich.; H. P. Gant, Glenmore, Pa.; E. Holt Gurney, Toronto, Ont.; C. V. Haynes, Portland, Me.; W. T. Jones, Boston, Mass., and C.-E. A. Winslow, New Haven, Conn.

Past President Gurney made the presentation speech on the memory book to be given to Dr. Winslow, as president of the Society in 1945. This book which would be similar to his own past presidential memory book, which he valued so highly, had been held at Canadian Customs at a value of $1,000,000, said Mr. Gurney. Dr. Winslow responded by expressing his great

T. H. Worthington

Mr. and Mrs. L. C. Medcalf

Leo Garneau

personal pleasure in having been allowed to serve the Society in its highest office. He paid tribute to the contribution of the Society to human comfort and welfare through its research and through the work of its members.

The Committee on Resolutions presented the following resolutions, which were adopted unanimously:

Resolutions

The Resolutions Committee appointed by President Offner offers the following:

WHEREAS, the great success of the 1946 Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS has been due to the careful and thorough preparations of the Montreal Chapter and affiliate Canadian Chapters, and

WHEREAS, the active effort of the Committe on Arrangements, under the able leadership of its General Chairman, F. A. Hamlet, and Leo Garneau, Vice-Chairman, supported by A. B. Madden, President of the Montreal Chapter, together with His Worship, the Mayor of Montreal,

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BE IT RESOLVED, that an expression of appreciation be adopted and that copies be sent to them and to each of the following:

To the Management and Staff of the Mount Royal Hotel for their able assistance;

To the Management and Staff of the Chateau Frontenac for their gracious hospitality;

To the Montreal Convention and Tourist Bureau for the tours and entertainment at Montreal;

To the Newspapers and Trade press of both Canada and the United States;

To M. Viau who represented His Worship the Mayor of Quebec, Lucien Borne, and to Honorable Paul Balyou, Minister of Trade and Commerce in the Provincial Government of Quebec representing the Prime Minister of the Province, for their participation in making the Banquet the climax of this very successful Society Summer Meeting;

To the Canada Steamship Co., especially Messrs. Bonter, Daly, Fisher and Captain Burch and all of his Staff who have, under these difficult times, rendered us such outstanding service and cooperation;

To the Speakers for the time and effort necessary to prepare the technical papers which were very well received and enjoyed;

To the eight past presidents of the Society who are with us at this Meeting.

These resolutions are offered for adoption.

Respectfully submitted,
Carl F. Boester, *Chairman*
L. T. Avery
J. E. Haines
W. E. Heibel
F. E. P. Klages
G. W. F. Myers

After the banquet members and guests returned to the *S. S. Quebec* which sailed for Montreal at 11:00 p.m.

Although wind and tide delayed arrival in Montreal Thursday morning, the 13th, it was the consensus of opinion of all who made the cruise that they had a wonderful trip and had enjoyed one of the best summer meetings ever held by the Society.

Chapter Delegates

There were 24 Chapters represented at the Chapter Delegates Committee Meeting which was held aboard the *S. S. Quebec* on Tuesday, June 11, with F. A. Leser, Washington, D. C., chairman, presiding. The duties of the Chapter Delegates were outlined by the chairman and among the subjects discussed were the necessity for a meeting agenda, membership activities, uniform chapter by-laws, speakers for chapter meetings, conducting chapter meetings, and a report by F. C. McIntosh, Pittsburgh, Pa., chairman of the Chapter Relations Committee.

L. P. Saunders, Lockport, N. Y., chairman of Committee on Research, received a check from the Pittsburgh Chapter and reported receipt of a check from the New York Chapter toward reduction of the mortgage on the Research Laboratory building.

T. F. Rockwell, Pittsburgh, Pa., gave a report of the work of the Guide Publication Committee and invited delegates to have their chapter members send comments and suggestions for improvement of the Technical Data section in THE GUIDE.

It was decided that future Chapter Delegates Meetings would provide a two-part session, one for business and reports and another for special discussions. It was also agreed that a resumé of previous Chapter Delegates Meetings would be made before the next Annual Meeting.

F. A. Leser was elected to serve as chairman of the Chapter Delegates Committee for the coming year.

C. M. Burnam, Jr., Chicago, Ill., served as secretary for the Committee.

ROCKWELL OPENS OFFICE IN PITTSBURGH

Theodore F. Rockwell announces the opening of an office for the practice of mechanical engineering at 900 Century Building, Pittsburgh 22, Pa.

Mr. Rockwell, formerly professor at the Carnegie Institute of Technology, joined the ASHVE in 1932 as a junior member and the following year was advanced to full membership in the Society. He served as president of the Pittsburgh Chapter in 1944, as its vice president the previous year and as its secretary for a period of seven years. He has been a member of various Research Technical Advisory Committees and is now serving on the TAC on Heating Load. Mr. Rockwell is chairman of the 1947 Guide Publication Committee now preparing the silver anniversary edition of THE GUIDE

ENGINEERING SOCIETIES COUNCIL OF NEW YORK ORGANIZED

Announcement was made recently at the Engineering Societies Building, New York, N. Y., of the organization of the Engineering Societies Council of New York, comprising delegates representing the local chapters of engineering, scientific and technical societies.

The purpose of the new organization in Greater New York is to enable the engineering profession to render a better coordinated program in the interests of the public and the members of the participating organizations.

The following officers were elected: *Chairman*, H. C. R. Carlson, *American Society of Mechanical Engineers; Vice Chairman*, H. P. Wall, *American Society of Safety Engineers; Secretary*, P. P. Davis, *American Society for Testing Materials;* and *Treasurer*, H. F. Dart, *Institute of Radio Engineers.* The announcement also stated that the following Directors were elected: O. B. J. Fraser, *American Institute of Mining and Metallurgical Engineers;* E. J. Lyons, *American Institute of Chemical Engineers;* W. F. O'Connor, *American Chemical Society;* C. S. Purnell, *American Institute of Electrical Engineers;* H. J. Ryan, AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS; and E. M. Sherwood, *American Society for Metals.*

In addition to Mr. Ryan the New

York Chapter of the ASHVE is represented on the Council by: W. A. Sherbrooke, M. C. Giannini and P. B. Gordon.

The purposes of the new Council are as follows:

To provide a medium for cooperative action by the member societies on matters of mutual interest which are beyond the scope of the individual organization or which can be performed better by cooperative action.

To encourage interest and participation in public affairs which are scientific or technical in scope.

To cultivate greater appreciation, by the public, affairs which engineering, science and technology contribute to human welfare.

To provide a means of more effective public service by the member societies of the Council.

To promote greater unification of the engineering profession and cooperate in a general program for the enhancement of the professional status of the engineer.

To promote coordination and integration of the inter-organizational activities of the member societies.

To publish information of interest to the member societies.

To cooperate with organizations having similar objectives in other communities.

F. W. HUTCHINSON APPOINTED SPECIAL HEATING CONSULTANT

F. W. Hutchinson, professor of mechanical engineering, Purdue University, Lafayette, Ind., and well known authority on radiant heating, has been appointed as consultant to Minneapolis - Honeywell Regulator Co., Minneapolis, Minn., as announced by J. E. Haines, vice president in charge of the company's commercial controls division.

In his capacity as consultant, Professor Hutchinson will assist the company engineers to determine proper methods of controlling radiant panel heating in all types of buildings. He will also assist the engineers in the preparation of a manual on the theory and application of radiant panel heating controls.

One of the nation's outstanding authorities in his field, Professor Hutchinson has spent the last ten years in research on panel heating. His studies included three years of work in nine countries of Europe where he surveyed more than 1,200 installations.

He received his B.S. from California Institute of Technology in 1931 and his M.S. and M.E. degrees from the University of California, where he spent eight years as associate professor of mechanical engineering, before accepting the appointment as professor of mechanical engineering at Purdue University in 1945. He is the author of numerous articles published in technical publications both here and abroad, as well as of many papers published in the Society's JOURNAL and TRANSACTIONS.

He joined the ASHVE in 1937 and early this year he was elected to serve as a member of the Society's Council for the three-year term. He is also a member of the Society's Committee on Research and of the Technical Advisory Committees on Air Conditioning in Industry, Air Sterilization and Odor Control, and Radiation and Comfort.

Professor Hutchinson is also a member of the *American Society of Refrigerating Engineers, Institute of Aeronautical Sciences, American Institute of Electrical Engineers, National Research Society*, the *Tau Beta Pi Engineering Society*, the *Sigma Xi* and is listed in *Who's Who in Engineering*.

F. W. Hutchinson

EDWIN A. BENNETT, NEW YORK, DIES SUDDENLY

Word has been received of the sudden passing of Edwin A. Bennett, engineer with the American Blower Corp., New York, who died on July 10, 1946, at the age of 41 following an operation.

Mr. Bennett was born and educated in New York City, graduating from Pratt Institute in 1926. Following his graduation he joined the staff of the American Blower Corp. where he remained for the past 20 years servicing, designing and testing all types of heating and ventilating equipment manufactured by the American Blower Corp.

He joined the Society in 1929 as a junior member and in 1936 he was advanced to full membership. He became affiliated with the New York Chapter of the Society in 1931.

In his work as sales engineer Mr. Bennett was widely known among architects, consulting engineers and contractors in the metropolitan area.

His host of friends in the heating and ventilating profession will regret his untimely passing.

He is survived by his wife, Edith Lundstrom Bennett; two sons, Edwin A. Bennett, Jr., and Alfred J. Bennett; and his parents, Mr. and Mrs. Alfred A. L. Bennett, to whom the Officers and Council of the Society extend their sincerest sympathy.

Funeral services were conducted at the Burr Davis Chapel, Mount Vernon, N. Y., on Saturday, July 13, and interment took place at Ferncliff Cemetery.

W. J. ARMSTRONG DIES IN MONTREAL

Walter J. Armstrong, professional engineer of Montreal and Toronto, died July 10, 1946 following a brief illness. Mr. Armstrong was responsible for the construction of many large buildings in Canada, including the Royal York Hotel in Toronto and the Mount Royal Hotel and Dominion Square Building in Montreal.

A native of Fair Hill, Md., he received his education at the Jacob Tome Institute in Maryland, the Mackenzie School, Dobbs Ferry, N. Y., and received his degree in mechanical engineering from Cornell University in 1909. He began his engineering career with Westinghouse, Church, Kerr and Co., New York. In 1913 he became associated with Ross and Macdonald, Architects, in Montreal, where he was in charge of the engineering department. In 1932 he formed his own firm as consulting engineer with offices in Montreal and Toronto.

Mr. Armstrong joined the Society in 1938, and the Officers and Council of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS extend their sincere sympathy to his widow and family.

SUMMARY OF LOCAL CHAPTER MEETINGS*

CONNECTICUT—June 20. The final meeting of the season was held at the Avon Country Club with golf in the afternoon followed by dinner. The after dinner speaker was Arthur B. McGinley, sports editor of the Hartford Times who gave a very interesting talk on the Louis-Conn fight which occurred the previous evening. All business was dispensed with. Attendance 64.

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MONTREAL—May 20. This meeting was a luncheon meeting with the annual factory inspection trip immediately after the business of the chapter was concluded. A complete review of the Semi-Annual Meeting plans was given by F. A. Hamlet, general chairman of the Committee on Arrangements. The inspection trip followed through the brass foundry and pipe bending shop of Crane, Ltd., which proved of great interest to the members. A vote of thanks was extended to the officials of the company for a very instructive afternoon. Attendance 32.

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NORTH TEXAS—July 16. Subject: Outline of the Theory and Action of Atomic Structure. Speaker: James W. May, director of research, American Air Filter Co., Louisville, Ky. Mr. May presented a splendid outline of the theory and action of atomic structure, the ionization of particles, and in particular, the performance of electronic air filtering which was demonstrated with a table model. His talk was followed by a lengthy period of discussion. G. A. Linskie, program chairman, in opening the business of the meeting brought up the question of whether the members preferred as many non-technical as they did technical meetings and asked for suggestions. He was given a vote of approval for his policy of alternating technical with non-technical sessions. Secretary B. S. Foss, Jr. then read a written report on the Semi-Annual Meeting in Montreal which brought about considerable discussion. Attendance 54. Attendance ratio 1.57.

NORTH TEXAS—June 17. Subject: Big Business Without Tax. Speaker: Joseph F. Leopold. Mr. Leopold made a highly entertaining and thought provoking talk particularly with reference to the legal ability of cooperatives to mushroom in size because of their freedom from federal income tax and he urged direct action on the part of each individual as taxpayers by writing to the Congressman and Senators of their respective districts. A short discussion followed. Attendance 32. Attendance ratio 1.38.

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ST. LOUIS—May 7. A tour of inspection of the mechanical department of Famous-Barr Company's air conditioning plant was enjoyed by members and guests, followed by dinner at the York Hotel. H. C. Sharp, chairman of the membership committee, reported on the status of the membership. The officers, as submitted by the nominating committee at the April meeting, were elected as follows: *President*—B. C. Simons; *First Vice President*—J. H. Carter; *Second Vice President*—B. L. Evans; *Treasurer*—J. S. Rosebrough; *Secretary*—W. A. Russell. *Board of Governors*: C. H. Burnap, J. F. Naylor, W. J. Oonk and H. C. Sharp. As master of ceremonies, George Myers and company put on a realistic criticism of the officers and general conduct of the affairs of the St. Louis Chapter during the past year. After considerable enjoyment the new officers were installed. A motion picture, *The Dawn of Better Living*, a colored animated cartoon by Walt Disney, was shown through the courtesy of Westinghouse Electric. Attendance 62.

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WESTERN MICHIGAN—June 6. Annual meeting held at the Elks Country Club, Kalamazoo, with golf, horseshoe pitching and soft ball games in the afternoon. Just before dinner Guy Kistler, professional fly and bait caster of the Shakespeare Co. gave a demonstration and showed the merits of the recently announced glass fly rod. Pres. H. J. Metzger appointed Messrs. L. A. Calcaterra, C. H. Pesterfield and H. D. Bratt to tabulate the results of the annual election The following officers were unanimously elected: *President*—J. W. Miller; *Vice President*—Frank Harbin, Jr.; *Treasurer*—H. W. Wolters; *Secretary*—K. E. Robinson. *Board of Governors*: H. J. Metzger, C. A. Simonds and J. H. Van Alsburg. Mohammed Sayed Sahab, Egypt, was one of the dinner guests. T. D. Stafford, acting as master of ceremonies, installed the newly elected officers, followed by the showing of a colored 16 mm film of Mexico, its scenery and its people, through the courtesy of M. C. J. Billingham, Kalamazoo. Attendance 99. Attendance ratio 1.55.

*Note. The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

CANDIDATES FOR MEMBERSHIP

The Constitution of the Society, as now amended, requires the following mode of procedure in voting on applicants for membership in the Society. All applications for membership are to be sent to the Secretary and the names of applicants and their references shall be printed in the next issue of the Journal of the Society or sent to the members in other approved manner as ordered by the Council. When the replies are received from references, the Candidate's application shall be submitted to and acted upon by the Committee on Admission and Advancement as soon as possible.

When the Committee on Admission and Advancement has acted favorably upon a Candidate's application and assigned his grade, the Council shall vote upon the election of the proposed Candidate for membership by letter ballot. During the past month 63 applications for membership have been received and the names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Committee on Admission and Advancement, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by September 10, 1946, these candidates will be balloted upon by the Council. Those elected to membership will be notified by the Secretary immediately after election.

ALLEN, MICHAEL H. P., Dir. & Gen. Mgr., Bell's Asbestos & Engineering, Ltd. PROPOSERS: T. N. Adlam, S. H. Overton*. SECONDERS: E. J. Ritchie, R. W. Cumming.

ANNABEL, CECIL H., Owner, Belsmith Co. PROPOSERS: W. O. Stewart, F. L. McDonald. SECONDERS: C. S. Anderson, L. H. Wagenbrenner.

AYRES, ROBERT O., Owner, Ayres & Co. PROPOSERS: R. J. Salinger, R. B. Johnson. Seconders: R. F. Taylor, C. S. Woodruff.

BAUER, JEAN, M.I.T. Grad. House. PROPOSERS: A. L. Hesselschwerdt, Jr., G. B. Wilkes. SECONDERS: J. R. B. Mallik, James Holt.

BEDARD, EARL L., Project Co-ordinator, Minneapolis-Honeywell Regulator Co. PROPOSERS: B. F. McLouth, T. S. Carley. SECONDERS: E. F. Snyder, Jr., G. D. Guler.

BELL, D. G., Gen. Mgr., North Texas Air Conditioning Co. PROPOSERS: J. D. Poythress, E. T. Gessell. SECONDERS: W. H. Moler, J. A. Ray.

BERGER, WILLIAM W., Sales Engr., John J. Nesbitt, Inc. PROPOSERS: H. B. Hedges, John McElgin. SECONDERS: D. C. Wiley, L. G. Paulding.

BOYENTON, JOHN F., Pres., Refrigeration Suppliers, Inc. PROPOSERS: R. C. Thomas, W. H. Webster, Jr. SECONDERS: E. L. Capps, F. D. Duval*.

BREY, JOHN O., Assoc., deLuca & Associates. PROPOSERS: Joseph Wheeler, Jr., E. H. Dafter. SECONDERS: S. E. Plewes, W. A. Grant.

BURTON, WALTER A., Sales Engr., Minneapolis-Honeywell Regulator Co. PROPOSERS: B. F. McLouth, J. E. Haines. SECONDERS: G. D. Guler, E. F. Snyder, Jr.

CASHIN, WILLIAM K., Vice-Pres., W. D. Cashin Co. PROPOSERS: L. E. Seeley, J. S. Webb. SECONDERS: W. A. McPherson, H. L. von Rehberg.

COLBY, JOHN W., Secy.-Treas., The Colton Corp. PROPOSERS: L. W. Millis, R. P. Campbell. SECONDERS: E. K. Campbell, Kirk Campbell.

COMBS, CHARLES F., Salesman, Russell J. Smith. PROPOSERS: Louis Steckhan, R. J. Smith. SECONDERS: W. J. Oonk, H. C. Sharp.

CROCKWELL, WALTER H., Salesman, Service Heat & Power Co. PROPOSERS: F. W. Kolb, James Gayner. SECONDERS: S. W. Terry, H. V. Hickman.

CURRY, WILLIAM H., Chief Engr., Milledgeville State Hospital. PROPOSERS: Buster Welch, J. A. Dodd. SECONDERS: H. K. McCain, S. W. Boyd.

DERBY, MALCOLM R., Engr., Kroeschell Engineering Co. PROPOSERS: A. H. Goelz, W. F. Christmann. SECONDERS: M. J. Bamond, C. M. Burnam, Jr.

DESPLANCHES, ANDRE, Pres. & Gen. Mgr., Procedes Ozonair PROPOSERS: Auguste Beaurrienne, R. C. Goenaga*. SECONDERS: Fernand Ghillardi, A. Nessi*.

FREDERICK, VERNON L., Capt., Corps of Engineers. PROPOSERS: A. E. Beitzell, W. E. Kingswell. SECONDERS: S. L. Gregg, A. C. Crawford.

FULLERTON, LAURENCE I., Pres., The Colton Corp. PROPOSERS: L. W. Millis, R. P. Campbell. SECONDERS: E. K. Campbell, Kirk Campbell.

FURBER, STANLEY L., Sales Engr., Minneapolis-Honeywell Regulator Co. PROPOSERS: W. A. Reichow, Henry Gould. SECONDERS: P. C. Leffel, L. E. Boyd *(Advancement)*

GERRISH, DAVID C., Application Engr., Minneapolis-Honeywell Regulator Co. PROPOSERS: J. E. Haines, B. F. McLouth. SECONDERS: E. F. Snyder, G. D. Guler.

GREEN, EDGAR L., Mech. Engr., Eastman Kodak Co. PROPOSERS: R. P. Cook, S. H. Downs. SECONDERS: J. Q. Treadway, L. M. Hakes.

GRUBBS, JOHN K., Mech. Engr., Kroeschell Engineering Co. PROPOSERS: A. H. Goelz, W. F. Christmann. SECONDERS: M. J. Bamond, C. M. Burnam, Jr.

HANDMAN, NORMAN J., Engr., Rogers Diesel & Aircraft Co. PROPOSERS: Peter Franck, C. S. Koehler. SECONDERS: F. M. Holbrook, J. W. Spiselman*.

HARRISON, HOWARD W., Htg. & Indus. Pr. Engr., Georgia Power Co. PROPOSERS: G. R. Bilderback, R. F. Hahn. SECONDERS: J. A. Dodd, J. M. Rittelmeyer.

HARRISON, MAURICE E., Htg. Engr., A. Brizard, Inc. PROPOSERS: S. W. Terry, J. M. Marr. SECONDERS: H. G. Smith, H. V. Hickman.

HOLMES, DONALD P., Mech. Engr., The Austin Co. PROPOSERS: A. B. Newton, P. J. Menden. SECONDERS: E. A. Jones, H. F. Brinen.

JENKINS, HARRY C., Sales Mgr., Moduflow Div., Minneapolis-Honeywell Regulator Co. PROPOSERS: J. E. Haines, B. F. McLouth. SECONDERS: E. F. Snyder, Jr., G. D. Guler.

JOHNSON, BLAINE A., Exec. Engr., Minneapolis-Honeywell Regulator Co. PROPOSERS: B. F. McLouth, J. E. Haines. SECONDERS: E. F. Snyder, Jr., G. D. Guler.

JONES, DAVID C., Mgr., Service Heat & Power Co. PROPOSERS: Robert Bruen, K. O. Alexander. SECONDERS: S. W. Terry, H. V. Hickman.

KASPARIAN, EDOUARD, Asst. Engr., The Egyptian Freezing Rooms Co. PROPOSERS: Georgess Aslanidis*, T. Khourchid*. SECONDERS: S. Kikhail*, M. Kazandjian*.

LUCE, JOHN A., Mgr., Htg. Dept., Federal Pipe & Supply Co. PROPOSERS: H. V. Hickman, N. H. Peterson. SECONDERS: K. O. Alexander, R. B. Holland.

MALLIK, J. R. B., Engr., Refrigerators (India), Ltd. PROPOSERS: James Holt, A. L. Hesselschwerdt, Jr. SECONDERS C. L. Svenson*, S. C. Collins* *(Advancement)*

MARTENIS, WILLIAM W., Chief Co-Ordinating Engr., Minneapolis-Honeywell Regulator Co. PROPOSERS: J. E. Haines, B. F. McLouth. SECONDERS: G. D. Guler, E. F. Snyder, Jr.

MASON, LAWRENCE T., Asst. Mech. Engr., Board of Education. PROPOSERS: H. P. Dolan, S. Van Vleish*. SECONDERS: Frank Clingon*, E. H. Trysell*.

MCCALMON, ROBERT T., Sales Engr., A. M. Byers Co. PROPOSERS: W. B. Simpson, C. A. Hawk, Jr. SECONDERS: F. L. Adams, G. D. Maves.

MENENDEZ, RAMON A., Prof. Engr. PROPOSERS: H. G. Carter, B. A. Thomas. SECONDERS: Richard Barthelmess, F. J. Beckwith.

MINDA, WALTER F., Sales Engr., Florida Hill York Corp PROPOSERS: E. A. Carsey, E. W. McNamee. SECONDERS: C. B. Smoot, H. F. Pierce*.

MOSER, WILLIAM O., Asst. Engr., Sumner L. Willson. PROPOSERS: C. W. Freeman, A. L. Wasserman. SECONDERS: H. B. Van Zelm, G. R. Couch.

MULLEN, C. HERBERT, Archt. PROPOSERS: J. T. Jones, H. A. Latterlee. SECONDERS: D. M. Allen, E. E. Ralston.

MUNRO, W. J., Pres., Munro Motor Co., Inc. PROPOSERS: Jack White*, Frank Kelly*. SECONDERS: Rev. Hildebrandt*, C. W. Buttz*.

NASSIR, NICHOLAS, Design Engr., C. F. Braun & Co. PROPOSERS: R. F. Lauer, E. J. Berlet, Jr. SECONDERS: Maron Kennedy, Leo Hungerford.

PETRINEC, JULIUS R., Draftsman, R. P. Allsop. PROPOSERS: Arthur Nearingburg, A. M. Kennedy. SECONDERS: R. P. Allsop, H. R. Roth.

PHILLIPS, D'ARCY E., Vent., Htg. & Air Cond. Engr., Newport News Shipbuilding & Drydock Co. PROPOSERS: F. R. Benson*, R. V. Terry*. SECONDERS: R. C. Thomas, W. H. Webster, Jr.

ROBESON, BEN P., Chief Engr., Columbia Specialty Co. PROPOSERS: W. E. Kingswell, W. C. Jones. SECONDERS: G. R. Walz, W. H. Littleford.

ROBSON, JAMES W., Sr. Asst. Mech. Engr., Detroit Board of Education. PROPOSERS: H. P. Dolan, S. Van Vleish*. SECONDERS: Frank Clingan*, E. H. Trysell*.

RONALD, EDWARD R., Partner, Warren & Ronald. PROPOSERS: Arthur Nutting, H. C. Murphy. SECONDERS: Howard Pound, John Hellstrom.

SAHAB, M. S. S., Student, Michigan State College. PROPOSERS: L. G. Miller, C. H. Pesterfield. SECONDERS: L. A. Tilford, V. H. Hill.

SARKAR, S. R., Chief Tech. Officer, Keymer Bagshawe & Co., Ltd. PROPOSERS: R. H. Anderegg, Reuben Trane. SECONDERS: H. Bentley*, William McNamara.

SHELFER, EDWIN L., Owner & Mgr., Shelfer Air Conditioning Co. PROPOSERS: G. C. MacEachin, E. T. Gessell. SECONDERS: Paul Baumann, J. A. Ray.

SIMPSON, WILLIAM D., Sales Engr., Buffalo Forge Co. PROPOSERS: H. L. Moore, W. R. Heath. SECONDERS: E. S. Tower, P. A. Edwards.

STEPAN, THEODORE E., Mech. Engr., Mississippi River Commission. PROPOSERS: F. D. Graham, E. G. Woodson. SECONDERS: Raymond Birchett*, B. F Marx*.

SUNDEEN, EARL E., Supvsr. & Designer of Air Cond. Systems, International Harvester Co. PROPOSERS: J. F. Tobin, J. S. Locke. SECONDERS: C. M. Burnam, Jr., J. F. Cummiskey.

SWANEY, FRANK J., Asst. Vice-Pres., Cargocaire Engineering Corp. PROPOSERS: J. W. Markert, E. E. Adams. SECONDERS: O. D. Colvin, T. R. Peyrek.

TAYLOR, HAROLD J., Chief Refrig. Engr., James J. Niven & Co., Ltd. PROPOSERS: E. M. Taylor, H. A. L. Vale. SECONDERS: Karel Rind, D. E. Fox.

TERHUNE, RALPH D., Mgr., Bryant Heater Co. PROPOSERS: C. H. Flink, K. T. Davis. SECONDERS: W. R. Teller, H. W. Heisterkamp. *(Advancement)*

THOMAS, HAROLD A., Mgr. & Estimator, Shelton Sheet Metal Works. PROPOSERS: J. E. O'Neill, Winfield Roeder. SECONDERS: H. J. Blakeley, F. A. DeLucia.

THOMPSON, CLIFFORD J., Pres., Thompson Research & Manufacturing Co. PROPOSERS: William Hukill*, W. P. Green*. SECONDERS: J. R. Winston*, M. N. Weatherhead*.

TRIMBLE, CLARKE R., Sales Engr., C. R. Trimble Co. PROPOSERS: W. W. Allen, R. E. Mason. SECONDERS: K. W. Selden, Jr., E. S. DeWitt.

TUTT, RICHARD D., Chief Engr., Tuttle and Bailey, Inc. PROPOSERS: Leonard Zavorski, Stanley Hart. SECONDERS: J. H. Smart, J. F. Wolff. *(Advancement)*

WAGNER, LEWIS D., Htg. Engr., Atlanta Gas Light Co. PROPOSERS: C. B. Cole, M. W. Wise. SECONDERS: J. A. Sheahan, R. G. Woodall.

WELSHMAN, HUGH, JR., Mgr., Indus. Piping Div., Grinnell Co., Inc. PROPOSERS: W. A. Sherbrooke, J. B. Coleman. SECONDERS: J. C. Hartwell, E. W. Gibbs.

WITSCHY, ROY J., Owner, Witschy Oil Co. PROPOSERS: J. E. Shedd*, C. N. Fleenor*. SECONDERS: W. A. Matheson*, Harry Cross*.

*Non-member.

CANDIDATES ELECTED

In the past issues of the Journal of the Society the names of the following men were listed as Candidates for Membership. The membership grade of each Candidate has been assigned by the Committee on Admission and Advancement and balloted upon by the Council. We are now instructed by the Council to post herewith, as required by Art. B-III, Section 8, of the By-Laws, the following list of candidates elected:

Members

ALLAN, JAMES E., Principal, Hunt & Allan, Cincinnati, Ohio.

AMEZAGA, MIGUEL F., Vice-Pres., Compania Electric de Cuba, Havana, Cuba.

AUSLANDER, GEORGE, Pres., Public Service Heat & Power Co., Long Island City, N. Y.

BARMANN, PAUL V., Pres., Lydick-Barmann Co., Fort Worth, Tex.

BLUM, ROBERT D., Sr., Appl. Engr., York Corp., York, Pa.

BROADWELL, HAROLD W., Appl. Engr., York Corp., York, Pa.

BRUCE, MARSHALL, Secy.-Treas., George W. Akers Co., Detroit, Mich. *(Advancement)*

BURR, L. R., Chief Engr., Kold-Hold Manufacturing Co., Lansing, Mich.

DODGE, RAYMOND V., Jr., Design Engr., American Viscose Corp., Roanoke, Va.

FINK, ROBERT C., Pres. & Mgr., Industrial Cooling & Moistening Co., Inc., Charlotte, N. C.

HALLE, SIMON, Owner, Halle's, Colorado Springs, Colo.

HANSEN, CLARENCE E., Secy., The Smith & Oby Co., Cleveland, Ohio.

HARPER, EVERETT C., Appl. Engr., York Corp., Atlanta, Ga.

HEATHCOTE, HENRY J., Mech. Engr., Carrier Engineering Co., Ltd., London, England.

HOLLINGWORTH, CHARLES E., Gen. Mgr., Baker Ice Machine Co., Inc., Los Angeles, Calif.

HOUSTON, LUCIUS S., Mech. Engr., Little Rock, Ark.

IRWIN, CONRAD P., Jr., Mech. Engr., J. R. Bracewell & Assocs., Atlanta, Ga.

KEMSLEY, JOHN A., Mgr., Htg. & Vent. Dept., Reunert & Lenz, Ltd., Johannesburg, South Africa.

LAGOW, ATWELL C., Engr., Leo L. Landauer & Assocs., Dallas, Tex.

LANG, GEORGE T., Engr., ASSA Ltda. S.A.I., Buenos Aires, Argentina, S. A.

LYONS, HUBERT W., Engr., Sharp & Dohme, Inc., Philadelphia, Pa.

MANDELL, LOUIS D., Jr., Asst. Sales Mgr., C. A. Dunham Co., Chicago, Ill.

MERLE, ANDRE, Charles H. Tompkins Co., Washington, D. C. *(Reinstatement)*

MORGAN, DAVID E., Asst. to Chief Research Engr., Warren Webster & Co., Camden, N. J.

OPPENHEIMER, PHILLIP H., Cons. Engr., Westfield, N. J.

PATERSON, W. B., Sr. Mech. Engr., Department of National Defense, Ottawa, Ont., Canada. *(Reinstatement & Advancement)*

RICHMOND GEORGE B., Mgr., Cooling & Vent. Dept., Hunter Fan & Ventilating Co., Memphis, Tenn.

ROWE, WILLIAM M., Field Engr., American Blower Corp., Cleveland, Ohio. *(Advancement)*

SAULSON, SAUL, Mech. Engr., Albert Kahn, Detroit, Mich. *(Reinstatement)*

STEVENSON, DANIEL B., Jr., Engr., Newcomb & Boyd, Atlanta, Ga.

TAYLOR, T. SMITH, Res. Dir. U. S. Testing Co., Hoboken, N. J. *(Reinstatement)*

TEUBER, HARRY N., Sales Engr., Warren Webster & Co., Camden, N. J.

TRAYNOR, JOHN H., Sales Engr., Johnson Service Co., Kansas City, Mo.

WALLACE, R. ROBERT, Hall-Neal Furnace Co., Indianapolis, Ind. *(Reinstatement)*

WARREN, OLIN A., Mech. Engr., Robson & Woese, Inc., Syracuse, N. Y.

WHITACRE, VERNE L., Dist. Mgr. of Insulation, Johns-Manville Sales Corp., New York, N. Y.
WHITT, SIDNEY A., Chief Engr., Cordley & Hayes, New York, N. Y. (*Advancement*)

YANCEY, FOSTER V., Air Cond. Engr., Atlanta Gas Light Co., Atlanta, Ga.

Associate Members

ALLSHOUSE, IRVIN P., Service & Constr. Engr., B. F. Sturtevant Co., Chicago, Ill.
ATKINS, OREN H., Designing Engr., United Electric Co., Monroe, La.
ATKINSON, RUSSELL R., Central Supply Co., Portland, Ore.

BAILEY, MURRAY C., C. A. Dunham Co., Ltd., Toronto, Ont., Canada.
BANAAG, VICTORINO V., Appl. Engr., General Electric Co., Bloomfield, N. J.
BEARDEN, JOHN D., Htg. Engr., Hall-Neal Furnace Co., Indianapolis, Ind.
BEECRAFT, GERALD A., Partner, Atlas Air Conditioning Co., Detroit, Mich.
BEGGS, PHILLIP B., Sales Engr., Paul W. Beggs & Son, San Francisco, Calif.
BISHOP, ALVIN C., Supt., Sheet Metal Div., D. F. Edwards Heating Co., St. Louis, Mo.
BRUCE, LEWIS E., Mgr., Htg. Dept., Skelgas Div., Skelly Oil Co., Kansas City, Mo.

COLBURN, GERALD W., Mgr., Minneapolis-Honeywell Regulator Co., Omaha, Nebr.
COLLINS, JOHN W., Chief Engr., National Heating Products Ltd., Montreal, Que., Canada.
CONNOR, WILLIAM A., Service Engr., Page-Hersey Tubes Ltd., Toronto, Ont., Canada.

DIXON, WILLIAM, Sales Engr., Nelson Co., Detroit, Mich.
DROEGKAMP, CALVIN F., Pres., Calvin Droegkamp Heating Co., Milwaukee, Wis.
DUGAN, JACK A., Sales Engr., Minneapolis-Honeywell Regulator Co., Seattle, Wash.

EVERT, MARTIN C., Secy., Alexander-Stafford Corp., Grand Rapids, Mich.

FLOETER, ELLIOTT G., Jr., Sales Engr., Way Engineering Co., Houston, Tex.
FREY, GEORGE W., Vice-Pres., Central Supply Co., Minneapolis, Minn.
FUCHS, JOSEPH, Supt. & Vice-Pres., Coon-Fuchs Inc., Buffalo, N. Y.

GAD, ALFRED, Refrig. & Air Cond. Engr., Cairo, Egypt.
GREGORY, KEGHAM S., Engr., York Corp., Houston, Tex.

HARRIS, ROBERT C., Sales Engr., Minneapolis-Honeywell Regulator Co., Omaha, Nebr.
HEARNE, RUFUS D., Sales Mgr., Wagner Engineering & Service Co., Milwaukee, Wis.
HOLMAN, ROBERT F., Office Supvsr., American Radiator & Standard Sanitary Corp., Atlanta, Ga.
HOLT, WHEELER M., Div. Mgr., B & B Engineering & Supply Co., Inc., Houston, Tex.
HORSBURGH, ALBERT E., Pres., Control Equipment Co., Ltd., Montreal, Que., Canada.
HOTZE, VINCENT, Owner, Hotze Heating Co., Cincinnati, Ohio.

JONES, WARREN L., Sales & Service Engr., Federal Supply Co., Oklahoma City, Okla.

KAENTER, RICHARD J., Htg. Engr., St. Louis Skelgas Co., Clayton, Mo.
KINKAID, JOHN R., Sales Engr., Dravo Corp., Cleveland, Ohio.
KNIPE, WILLIAM E., Owner, William E. Knipe Sales & Service, St. Louis, Mo.
KOHN, WALTER P., Indus. Appl. Engr., York Corp., York, Pa.
KOPER, CHARLES H., Sales & Field Engr., B. F. Sturtevant Co., Cleveland, Ohio.

LARSON, CARL W., Engr., McQuay, Inc., Minneapolis, Minn.
LEGGET, REGINALD J., Plbg. & Htg. Contr., Montreal, Que., Canada.
LEWIS, HAROLD H., Partner, Gieske Sheet Metal Co., Kansas City, Mo.
LINDEMAN, CLAUDE F., Owner, Claude F. Lindeman Plumbing & Heating, Indianapolis, Ind.
LINN, GERALD B., Mech. Engr., The Austin Co., Cleveland, Ohio.
LUX, ALEC C., Asst. Supt., Steam Heat Dept., Puget Sound Power & Light Co., Seattle, Wash.

MASTERSON, WILLIAM R., Cons. Engr., Edward F. Masterson & Son, Salem, Mass.
MCCOY, FLOYD F., Owner, Floyd F. McCoy Heating Co., Bay City, Mich.
MERICLE, CLIFFORD D., Assoc. Editor, *Air Conditioning & Refrigeration News*, Detroit, Mich.
MOLE, HUGH W., Engr., Norton Co., Chippawa, Ont., Canada.
MOORE, VERNON A., Archt., Norfolk, Va.
MULRONEY, GEORGE J., Branch Sales Office Mgr., C. A. Dunham Co., Ltd., Quebec, Canada.
MUTIMER, A. G., Dist. Mgr., B. F. Sturtevant Co., Camden, N. J.

NACHLAS, OTTO M., Partner, Ben Cash & Co., Houston, Tex.
NORTON, ERNEST H., Owner, Seattle, Wash.

PELLETIER, L. E., Exec. & Tech. Advisor, Bridgeport Brass Co., Bridgeport, Conn.
PLAYER, FRANK A., Mgr., Mehring & Hanson Co., Atlanta, Ga.
POWITZKY, CALVIN E., Asst. Mgr., Jamar-Olmen Co., Houston, Tex.
PRESSLER, J. D., Chief, Mech. Engrg. Dept., A. M. Strauss, Fort Wayne, Ind.

QUACKENBUSH, JOHN M., Partner, Quackenbush Co., Buffalo, N. Y.

REICH, HERBERT H., Mech. Engr., Power Piping Div., Blaw-Knox Co., Pittsburgh, Pa.
ROCHE, GEORGE J., Pres.-Treas., Roche & Hull, Inc., Baltimore, Md.
RYAN, FRANK J., Mgr. & Supvsr., William D. Ryan, St. John's, Newfoundland.

SALAUN, HAROLD L., Comm'l. Supvsr., New Orleans Public Service, Inc., New Orleans, La.
SCHOENHERR, EDGAR J., Mech Engr., Department of Public Works, Ottawa, Canada.
SCHULTZ, CLYDE W., Crane Co., Council Bluffs, Ia.
SEIBERT, EARL W., Pres., Advanced Refrigeration Co., Hamilton, Ohio.
SIMPSON, JOHN A., Archt., Norfolk, Va.
STAMPS, HAROLD F., Field Engr., Henry Valve Co., Chicago, Ill.
STOKELY, JOHN M., Pres., Stokely's Services, Inc., Norfolk, Va.
SZOMBATHY, ALFRED R., Sales Engr., Ferguson Sheet Metal Works, Inc., Ferguson, Mo.

TEJEDA, S. M., Cons. Engr., Mexican Government, Mexico, D.F., Mexico.
TEMPLETON, H. J., Dist. Mgr., American Blower Co., Dallas, Tex.
THOMPSON, Q. P., Sales Engr., Minneapolis-Honeywell Regulator Co., Buffalo, N. Y.
TRODD, EDWARD R., Asst. Engr., Canadian Pacific Railway Co., Montreal, Que., Canada.

ULOVEC, HENRY F., Asst. Secy. & Chief Engr., Mehring & Hanson Co., Los Angeles, Calif.

VAN EPPS, HAVERLY H., Precip. Engr., Westinghouse Electric Corp., Chicago, Ill.
VENNING, JOHN R., Sales Engr., Owens-Corning Fiberglas Corp., Cleveland, Ohio.

WARNER, J. B., Naval Archt., Norfolk Naval Shipyard, Portsmouth, Va.
WESTON, CHARLES E., Contr., American Home Heating Co., Buffalo, N. Y.

YANCEY, RICHARD H., III, Appl. Engr., Advanced Refrigeration, Inc., Atlanta, Ga.

Junior Members

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Northern Ohio: Organized, 1916. Headquarters, Cleveland, Ohio. Meets, Second Monday. President, J. E. Wilhelm, 1906 Euclid Ave., Cleveland 15. Secretary, D. E. Mannen, Jr., 4517 Silsby Rd., University Heights.

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Western Michigan: Organized, 1931. Headquarters, Grand Rapids, Mich. Meets, Second Monday. President, J. W. Miller, Route 5, Box 498, Lansing. Secretary, K. E. Robinson, 211 Smith Ave., Lansing 10.

Western New York: Organized, 1919. Headquarters, Buffalo, N. Y. Meets, Second Monday. President, Herman Seelbach, Jr., 45 Allen St., Buffalo 2. Secretary, F. J. Weber, 443 Delaware Ave., Buffalo 4.

Wisconsin: Organized, 1922. Headquarters, Milwaukee, Wis. Meets, Third Monday. President, E. W. Gifford, 611 N. Broadway, Milwaukee 2. Secretary, B. M. Kluge, 1817 S. 66th St., Milwaukee 14.

Industrial Ventilation Problems Studied

A recent survey of available design data on industrial ventilation confirmed the need for better information on systems to control industrial atmospheric pollution by means of ventilation and as this subject has been a matter of common interest to the ASHVE and the U. S. Public Health Service, a program of research in this field was inaugurated.

Last October Dr. A. D. Brandt was assigned to the Society's Research Laboratory by the Public Health Service in order to assure more efficient correlation of the activities of the two agencies. With the suggestion resulting from the Society sponsored Industrial Ventilation Conference held in Detroit in March 1945, plus the results from a questionnaire answered by 113 of 200 interested in the subject, it was established that about half of the official Industrial Hygiene agencies, less than half of the architectural and consulting engineering firms and extremely few universities had design data available. It was noted also that there was an almost universal desire for more dependable factual data on the design of industrial ventilation systems.

A long-range program of research was planned and work on the program was started immediately under Dr. Brandt's direction and the first two studies have been completed and the results presented, on the nature and magnitude of energy losses at suction openings, at the Semi-Annual Meeting of the Society in Montreal.

Another study deals with the nature of air flow in front of and into suction openings. Data have been collected on the relationship of the centerline or axial velocity in front of suction openings to the volume rate of air flow on both unflanged hoods, and on hoods having large flat surfaces adjacent to one or more edges. The results of both studies will be published in the near future.

Though Dr. Brandt's assignment at the ASHVE Research Laboratory ended June 30 last, with his resignation from the Public Health Service, arrangements are under way to carry on the program and the Committee on Research is enlisting the continued cooperation of the Public Health Service in these studies.

An Invitation to Members

The Council wishes to encourage authors to contribute good technical papers for presentation to our Society, particularly papers dealing with new or novel developments. Good papers on air conditioning of all kinds and new papers on air distribution, industrial hygiene and industrial ventilation are of interest. A special committee has been appointed to secure papers. The membership of the Committee on Technical Papers is composed of G. L. Tuve, chairman; L. T. Avery, Walter Heibel, C. H. Flink, and Cyril Tasker.

Any one of the committee members will be glad to consult by mail or otherwise with authors to predetermine whether the particular subject is desired.

Papers must be presented first to the Publication Committee for approval for publication and then are passed on to the Meetings Committee for selection to use at the Annual or Semi-Annual Meetings. We need papers planned now to take care of the Annual Meeting in January, 1947. If you have any papers you would like to suggest, please communicate with any of the committee members.

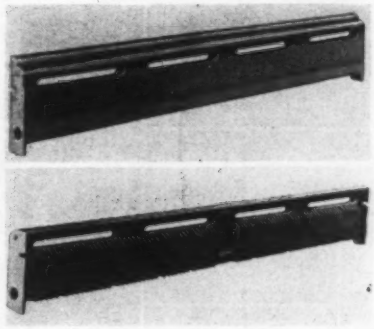
EQUIPMENT DEVELOPMENTS

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January 1946 Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk equipment and manufacturer not listed.

Radiant Baseboard for Large Areas

No. 3202—Development of the "Hy-Power Base-Ray" radiant baseboard for heating large areas or for rooms in which baseboard space is at a minimum, has been announced by the Burnham Boiler Corp., Main St., Irvington, N. Y.

Like the standard model, this unit operates on any hot water, two pipe steam, or vacuum system and can be used in new construction and in modernized buildings. It is designed to deliver approximately 60 per cent more heat than the standard model and is recommended for rooms where greater heat output is desired and where baseboard space prevents a room-long installation of the standard type. Greater heat output is said to be achieved by means of vertical fins on the back of the unit.



Despite its greater heating capacity, this panel is almost the same size as the standard and, when painted to match the woodwork in a room, is inconspicuous. It is 7 in. high and 2 in. thick. An ordinary wood molding, to complete the effect of a baseboard, is installed at the top of the unit.

In order that fuel costs may be held to a minimum, the manufacturer recommends that the outside walls in which the radiant baseboard is installed be insulated to a minimum height of 12 in. from the floor. Insulation bats or loose insulation placed between the studs is suggested.

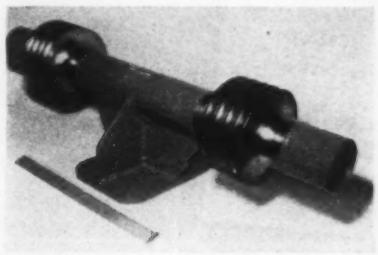
Bottled Fluorine

No. 3203—Fluorine, the most chemically active element known, is now available, in steel pressure cylinders, on a limited commercial basis. The gas is marketed by the Pennsylvania Salt Mfg. Co., Widener Bldg., Philadelphia 7, Pa.

While various compounds of the element such as anhydrous hydrofluoric acid, Cryolite, and the "Freons" are used extensively, this is the first time that the gas has been offered on a commercial basis. It is available in comparatively small amounts, at present ½ lb at 200 psi each cylinder, for chemists, researchers, and manufacturers.

Packless Expansion Joint

No. 3204—The MagniLastic Div. of Cook Electric Co., 2700 N. Southport Ave., Chicago 14, Ill., has announced its new "Anchor Joint" line of packless expansion joints.**



The device is said to combine rigid anchoring of piping at accessible points, with allowance for unequal thermal expansion and contraction on either side of the anchor point, due to differences in pipe length, ambient temperatures, exposure, etc. This is accomplished by varying the number of bellow flanges on either side of the anchor base to accommodate various conditions encountered. Where severe hydraulic surges within piping occur, the unit is also said to minimize the transmission of shock to fittings and adjacent structures.

Joints are made for standard pipe sizes from ½ to 24 in. The expansion flanges are supplied from any one of the company's 25, 55, 150, 400 or 1000 lb series, to accommodate all pressures from vacuum to 1000 psi. Joints of stainless steel, monel, inconel and copper are available. Temperatures handled range from —300 F to 1600 F. A variety of standard fittings such as elbows, tees, ells, Y's, etc. can be incorporated to make a single unit. Welding ends, as shown in the accompanying illustration, are regularly supplied with pipe flanges and inner linings optional.

Refrigerant Condenser

No. 3205—The Niagara Blower Co., 6 E. 45th St., New York 17, N. Y., has introduced the "Aero-Pass" condenser which has been developed for condensing refrigerant gases with automatic, year-around operation.

(*Continued on page* 158)

Heating, Piping & Air Conditioning, [8-46]
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Recent Trade Literature.

(Circle each number in which you are interested)

3202	3203	3204	3205	3206	3207	3208	3209	3210	3211
3212	3213	3214	3215	3216	3217	3218	3219	3220	3221
3222	3223	3224	3225						
6239	6240	6241	6242	6243	6244	6245	6246	6247	6248
6249	6250	6251	6252	6253	6254	6255	6256	6257	6258
6259	6260	6261	6262	6263	6264	6265	6266	6267	6268

Name..... **Title**.....

Company .....

Address .....

City..... **Zone**..... **State**.....

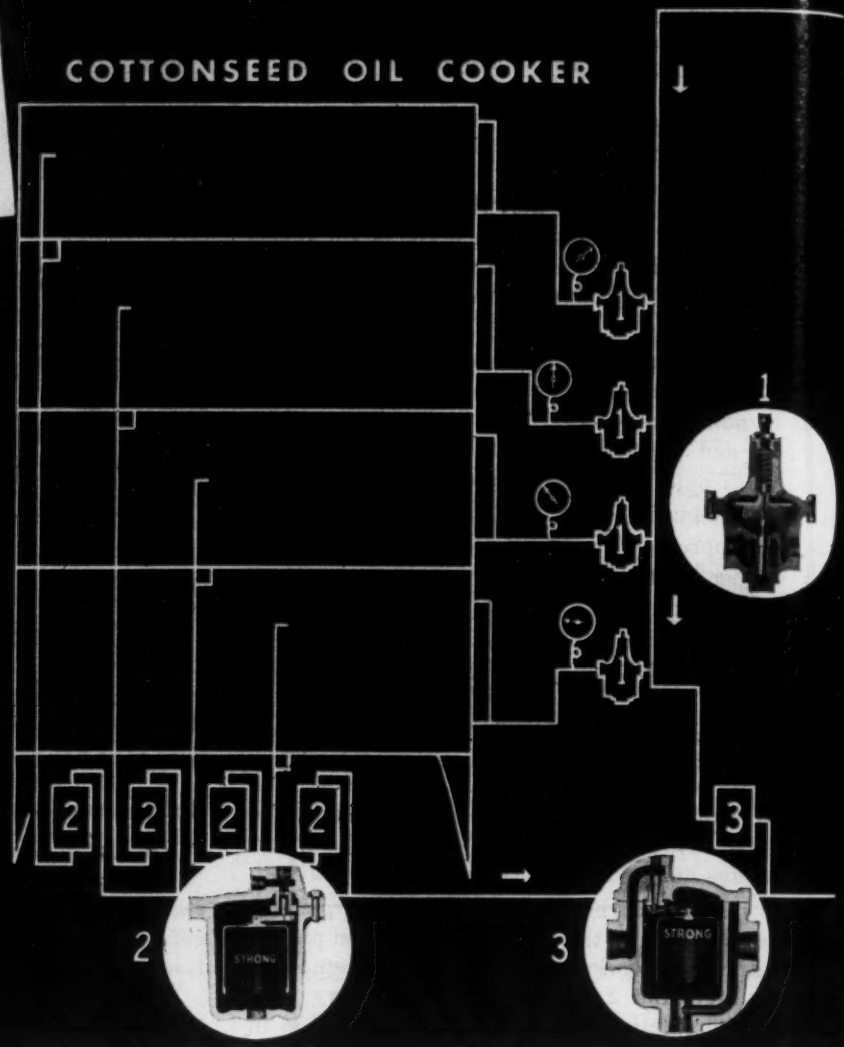
Double Problem in Steam

1 Control and variation of temperatures in four steam sections.

2 Correct drainage to insure maintenance of cooking temperatures.

HERE'S STRONG'S *Suggestion:*

1. Since temperature varies directly with steam pressure install Strong's variable pressure reducing valves (Type K with Anum-Metl disc and seat and integral strainer) on inlets of each section. Pressure gauges in reduced side of line provide easy visual control, eliminating maintenance of temperature regulator bulbs.
2. Use Strong's Series 80 inverted bucket traps with Anum-Metl valves and seats to drain each section. Insure positive drainage and uniform cooking of meats.
3. Small Strong series 70 inverted bucket trap with Anum-Metl valve and seat drains main header, insuring a constant supply of live steam at each reducing valve.



Time-temperature processes depend on both!

Cottonseed cookers, in common with all time-temperature steam processes, require both accurate pressure control and complete, automatic condensate removal. In this case, bright, high-quality oils depend upon how accurately equipment operates.

Knowing the problems involved, and having the steam specialties needed to solve them, Strong steam engineers can give unbiased, practical recommendations that insure satisfactory operation of your time-temperature processes. This calls for close attention t drainage equipment to fit the variables in each insta lation, determine peak loads, time required to reac temperature, etc.

For any trap need, open or inverted bucket, floa float and thermostatic—in cast or semi-steel, forged o welded construction—call on

STRONG, CARLISLE & HAMMOND CO., Cleveland 13, O

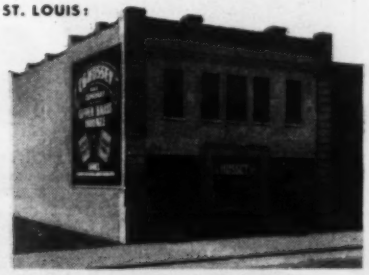
OTHER ANUM-METL Reg. Trade Mark

STRONG

STEAM SPECIALTIES

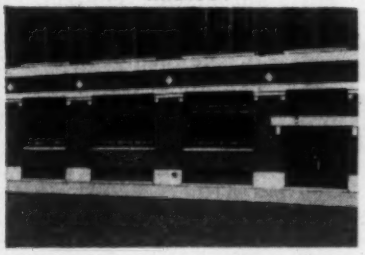
Blast Trap | Strainer | Large Capacity Trap

ST. LOUIS:



1620 Delmar Blvd., St. Louis 3, Missouri
CEntral 9192

CHICAGO:



212 South Jefferson St., Chicago 6, Ill.
HAymarket 5607

CINCINNATI:

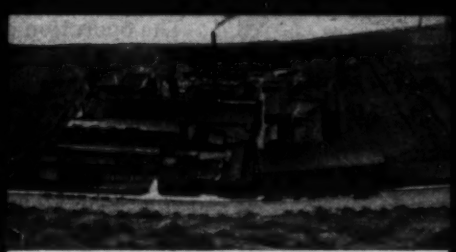
424 Commercial Square, Cincinnati 2, Ohio
MAin 2833

PITTSBURGH

HUSSEY

THE METAL WITH A BRILLIANT FUTURE

COPPER



2850 Second Ave., Pittsburgh 19, Pa.
GRant 3650

Quickly Available Through Modern Warehouses Located in Important Industrial Centers

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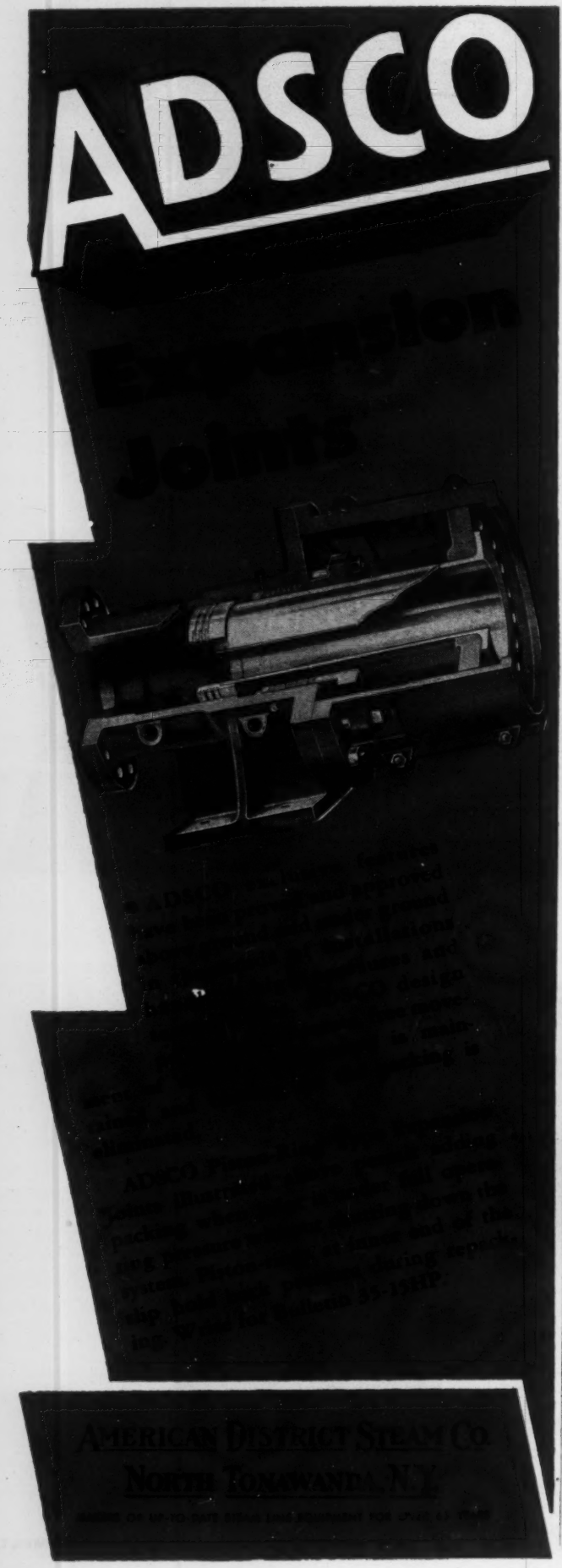
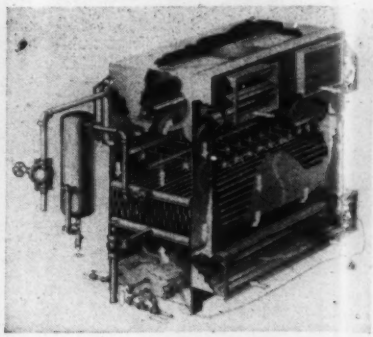
C. G. HUSSEY & COMPANY
(Division of Copper Range Co.)
ROLLING MILLS and GENERAL OFFICES: PITTSBURGH, PA.

HUSSEY WAREHOUSES CARRY STOCKS OF COPPER AND BRASS PRODUCTS FOR PROMPT SHIPMENT.



(*Continued from page* 155)

The purpose of the equipment is to obtain economical operation of refrigeration machinery by constantly producing, under automatic control, low head pressures at the compressor. The apparatus consists of two condensing coils, the first of which is a dry coil in which the temperature of the gases is reduced close to the point of condensation. The second coil is sprayed with water, which, as it is evaporated in a fan-induced air stream, reduces the gas temperature further and causes condensation of the refrigerant. The water is recirculated and only the amount evaporated is consumed. In addition, a "Balanced Wet Bulb Control" is used. This device is designed to automatically recirculate some of the air as necessary to obtain full condensing capacity and to hold the minimum head pressure required.



The operation of the unit is automatic so that in cold weather the sprays and fans are shut off and the water feed line is drained. A rise in head pressure to a predetermined point puts the unit into operation.

Steam Generator

No. 3206—The "Steam-Pak" generator, manufactured by York-Shipley, Inc., Industrial Div., York, Pa., is designed to burn any oil from No. 3 to No. 6.

The generator units are offered in two series; low pressure units in various sizes up to 13,500 EDR steam rating, and high pressure models in various sizes up to 100 hp. Assembly line procedure is being employed in the production of these generators. Shown here is a group of 30 hp units being assembled.

To Manage New Gas Appliance Mfg. Plant

No. 3207—L. C. Harvey, president of The Bryant Heater Co., 17825 St. Clair Ave., Cleveland, Ohio, has announced appointment of Gordon Rieley, vice president of the company, as general manager of a new plant now being completed in Tyler, Tex.

Production in the new plant, for which ground was broken in October, 1945, was to begin in August, with gas-fired hot water heaters scheduled as the initial item of production. Manufacture of space heaters and

No wear!
No slips!
No deadlines missed!

DAYTON V-BELTS

absorb shocks...eliminate slippage

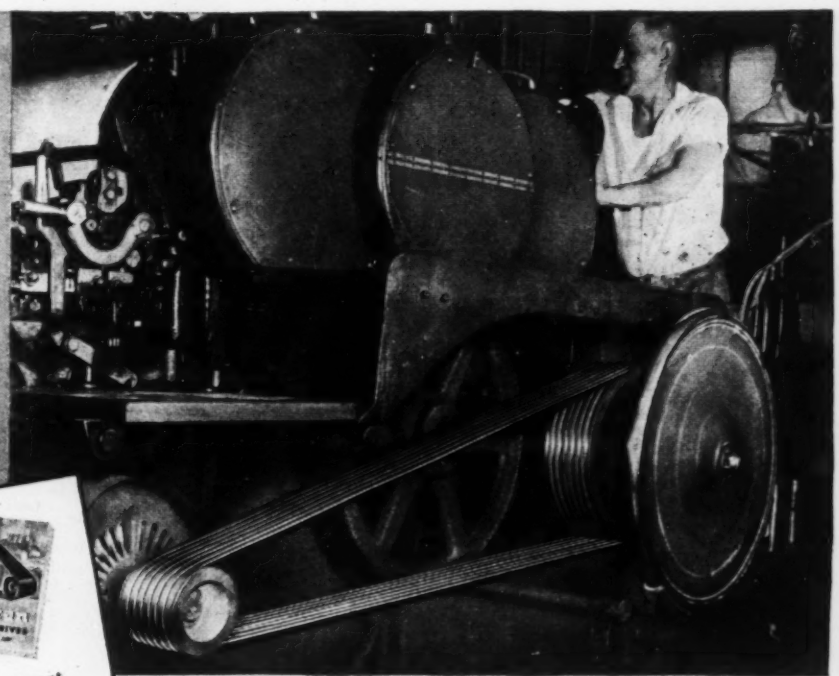
PROVIDE POSITIVE POWER TRANSMISSION

Original belts on the two-color presses of one of the country's largest printing plants started and stopped the presses with an abrupt shock . . . slipped frequently, causing uneven operation. Result was excessive wear on press parts and motor armature, requiring frequent repair. Moreover, belts broke frequently, causing complete shutdowns, loss of production and sometimes missed deadlines. Troubled, management tried Dayton V-Belts. Now power is delivered evenly, presses start and stop smoothly, belt slippage has been eliminated . . . maintenance costs have been reduced . . . production has been stepped up. Dayton V-Belts transmit power smoothly and positively because the *engineered* resilience of Dayton V-Belts, and the seating action of the belts in the pulley grooves, absorb the shocks of suddenly applied power. Their scientific design and construction is the result of over 40 years of research and manufacturing experience working with natural and synthetic rubber. It is experience that can help you solve your power transmission drive problems. For full information write The Dayton Rubber Manufacturing Company, Dayton 1, Ohio.

ATTENTION

POWER TRANSMISSION ENGINEERS:

There is a mill supply house near you that stocks Dayton V-Belts. A representative will gladly discuss your power transmission drive problems with you. Look for the name under the trade name heading "Dayton V-Belts" in the yellow pages of your telephone book.



WRITE TODAY FOR YOUR DAYTON CATALOG:

The Dayton No. 280 catalog contains 384 pages of tables and data that make selecting the correct V-Belt Drive quick and easy. Write for your copy today. It's free.

THE DAYTON RUBBER MANUFACTURING CO.
DAYTON 1, OHIO

Dayton Rubber
THE MARK OF TECHNICAL EXCELLENCE IN SYNTHETIC RUBBER

THE WORLD'S LARGEST MANUFACTURER OF V-BELTS

other gas appliances will follow to complete the line of products assigned to the new plant, which contains 105,000 sq ft of floor space.

Mr. Rieley has been associated with the company for the past twelve years, where he has specialized in market research and analytical phases of sales and production. A native of Cleveland, he is chairman of the house heating division of the Gas Appliance Manufacturers Association.

Heavy Duty Pumping Unit

No. 3208—A new, heavy-duty pumping unit with integrally-mounted reduction gear drive has been put into production by the Blackmer Pump Co., 1920 A Century Ave., S. W., Grand Rapids 9, Mich.

The new pump is designed on the swinging vane (bucket design) principle, which is said to make it self-adjusting for wear. It has a capacity of 750 gpm at 150 psi discharge pressure and operates at 225 rpm. The internal construction is bronze-fitted, and units are furnished with either anti-friction or sleeve bearings. The base is structural steel and provides for pump and reduction drive unit only. The prime mover, either engine or electric motor, is mounted separately.

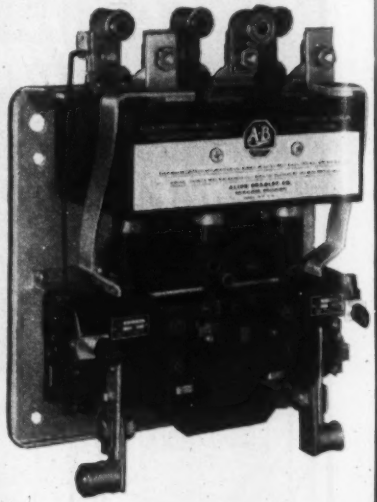
A number of the new units are being furnished for pumping fuel oil and lube oil on cargo vessels.

Present plans call for the production of units of similar design with speed variations from 150 to 400 rpm and capacities of 200, 300 and 400 gpm with pressures from 50 to 150 psi for general industrial as well as marine use.

300 Amp Solenoid Starter

No. 3209—Allen-Bradley Co., 1311 S. First St., Milwaukee, Wis., has developed the Size 5, Bulletin 709 solenoid starter which is rated at 100 hp, 220 volts and 200 hp, 440-550-600 volts.

The new unit replaces the older, Bulletin 710, Size 5 clapper starter manufactured by the company. All of the features of the company's smaller solenoid starters are said to be incorporated in this unit. Contact cleaning, filing, or dressing is avoided by the use of cadmium silver contacts. These double break contacts are encased in an arc hood, each pole of the switch having its individual arc chamber.



The solenoid design has made possible a reduction in the size of the starter as compared to the clapper type which is now replaced. The unit is mounted on a self-insulated metal base plate, which may be mounted on any metal surface without extra insulation, and it is available with or without an enclosure.

SOMETHING NEW HAS BEEN ADDED

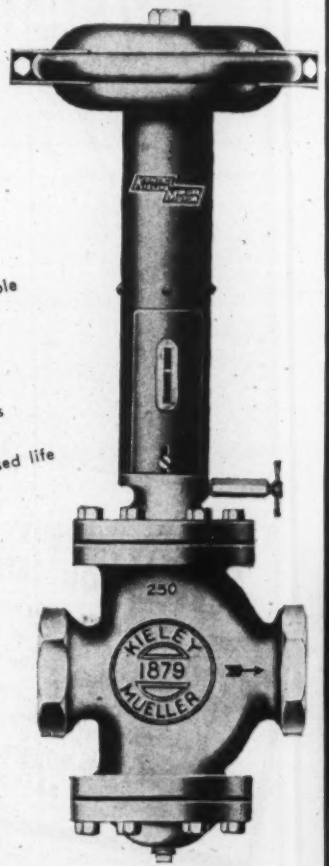
Kieley & Mueller presents

KONTROL MOTOR

Diaphragm Motor Valves
Pressure Regulators
Pump Governors

featuring

- All Steel Diaphragm Motor Unit . . . lighter, tougher, stronger, more durable
- Boltless "Duoseal" Diaphragm Casing . . . tight sealing, quick acting clamp ring; molded highly flexible neoprene diaphragm
- Steel Tubular Yoke . . . enclosing long, heat-treated, cadmium plated spring; packing gland and spring adjustment accessible through door
- Valve Position Indicator . . . standard equipment; no extra charge
- High Capacity Valve Bodies . . . unrestricted flow areas, smooth flow; available in bronze, semi-steel, cast steel, and special alloys
- Superfinished Disc Guides . . . top and bottom guided Bevel, Percentage V Port, and Parabolic discs; minimum friction, increased life
- Modern Design . . . to meet modern process requirements for better control

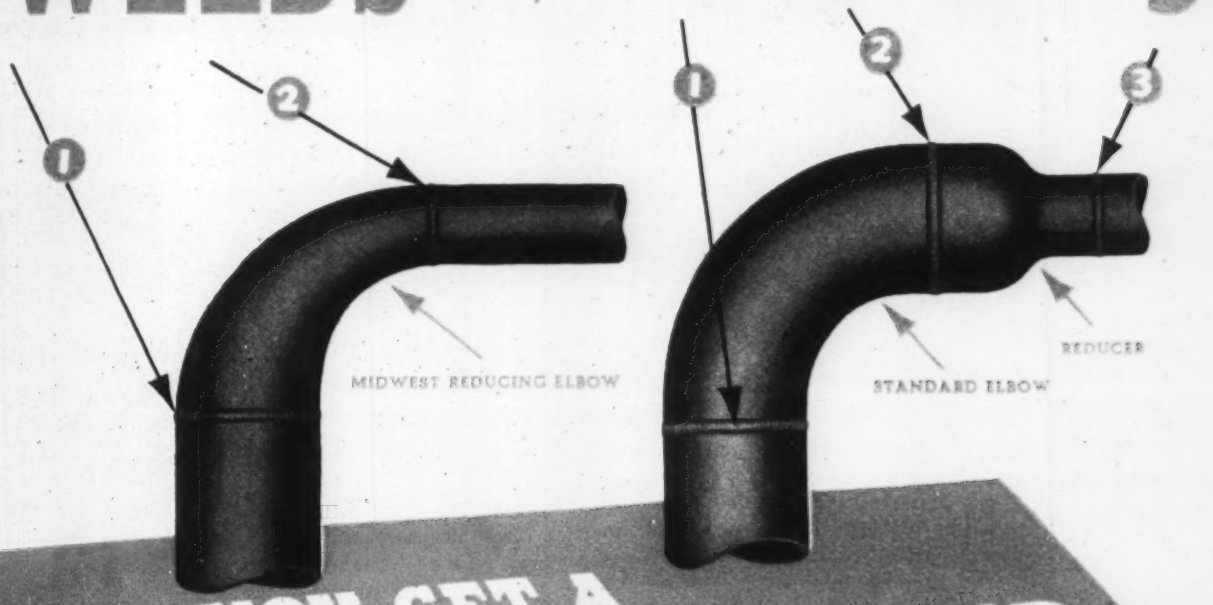


KONTROL KIELEY & MUELLER MOTOR

Write now for bulletin on the revolutionary KONTROL MOTOR valves.

KIELEY & MUELLER, INC., NORTH BERGEN, NEW JERSEY

2 WELDS INSTEAD OF 3



AND YOU GET A BETTER PIPING JOB

MIDWEST

REDUCING WELDING ELBOW

- SAVES WELDING
- SAVES MONEY
- SAVES TIME
- REDUCES TURBULENCE
- IMPROVES APPEARANCE

One weld is eliminated when the Midwest Reducing Elbow is used to change both direction and pipe size in a welded pipe line . . . you make only two welds instead of three. This exclusive Midwest Fitting takes the place of both a standard elbow and a reducer, as shown above. This saves time and money, produces a smoother, cleaner, better appearing job. In addition, the gradual reduction, smooth curve and absence of abrupt neck reduce turbulence. Insulation is also easier.

All the advantages of Midwest Standard Elbows are to be found in Midwest Reducing Elbows . . . unusual dimensional accuracy, beneficial effect of working metal in compression, stress relieving, etc. Center-to-end dimensions are the same as for standard elbows with which they are interchangeable.

This reducing elbow is one of many Midwest Welding Fittings designed to reduce the cost and improve the quality of welded piping. Write for Bulletin WF-41 for complete information.

MIDWEST

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Main Office: 1450 South Second St., St. Louis 4, Mo.

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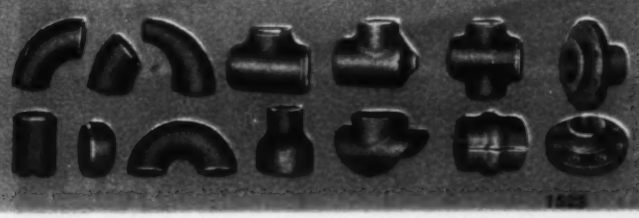
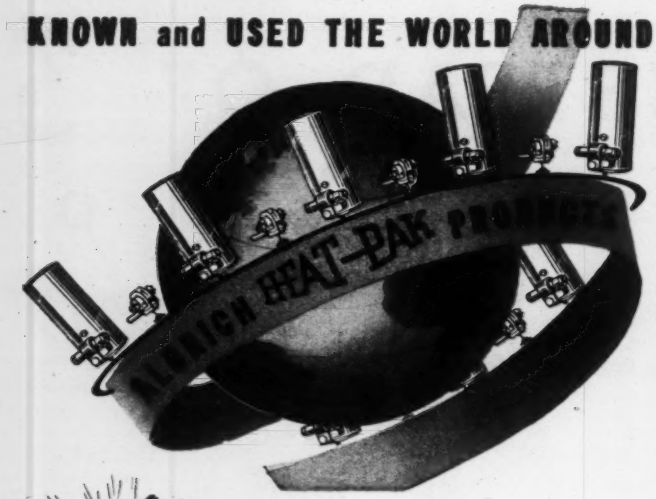
MIDWEST WELDING FITTINGS IMPROVE DESIGN AND REDUCE PIPING COSTS



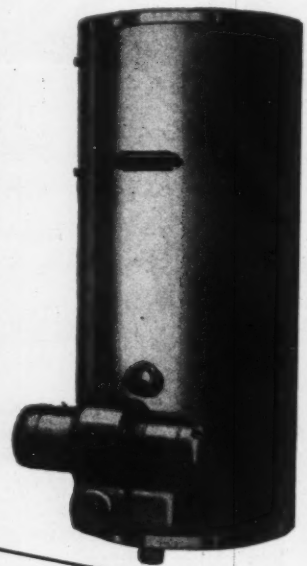
KNOWN and USED THE WORLD AROUND



Aldrich Oil Burners and Burner-Boiler Units were standard equipment in United States Insular Bases the world around. That's proof of unmatched efficiency, performance . . . All during the war, Aldrich Co. worked night and day at their regular job—producing extra-value burners and burner-boiler units . . . Post war improvements are facts—not promises—in Aldrich equipment.

HEAT-PAK Burners Models AX and BX

Embodying famous Aldrich features, HEAT-PAK Model AX (.75 to 5.00 G. P. H.) and Model BX (4.00 to 9.00 G. P. H.) are being produced as fast as materials become available . . . Production of famous HEAT-PAK Burner-Boiler Units and oil-fired Water Heaters is limited only by manpower and materials.



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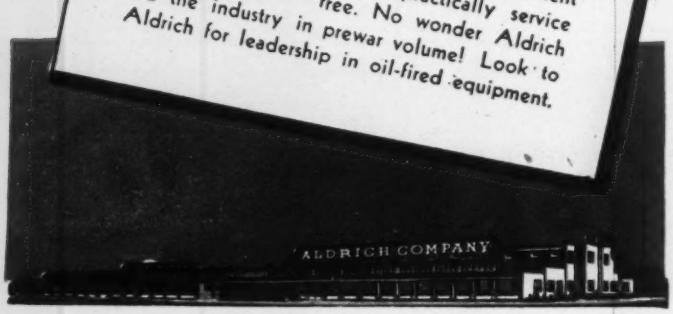
SERVICE-FREE

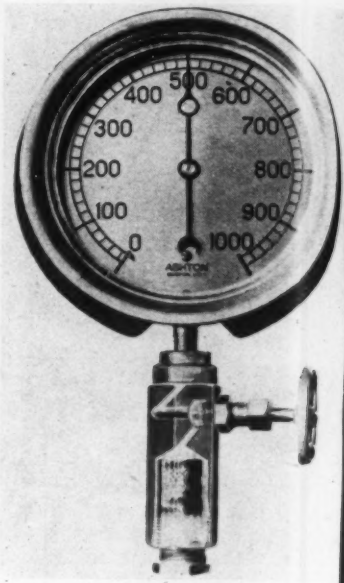
Aldrich engineering genius, designing skill, and production experience combine to give you equipment that is practically service free. No wonder Aldrich led the industry in prewar volume! Look to Aldrich for leadership in oil-fired equipment.



Pulsation Dampener for Gages and Governors

No. 3210—An improved "Micro-Bean" pulsation dampener for gages and governors is being produced by J. A. Campbell Co., 645 E. Wardlow Rd., Long Beach 7, Calif.**

It is available both in all-brass and all-steel with stainless steel stem. No piston is used. The new model is said to overcome the scoring problem. The manufacturer states that most dampeners have a tendency to score out after a year or two. To overcome this problem, a screw has been provided, which when turned slightly, will bring back the seating to perfect control. This can be repeated every two years or so, giving the device an estimated life of about 100 years.



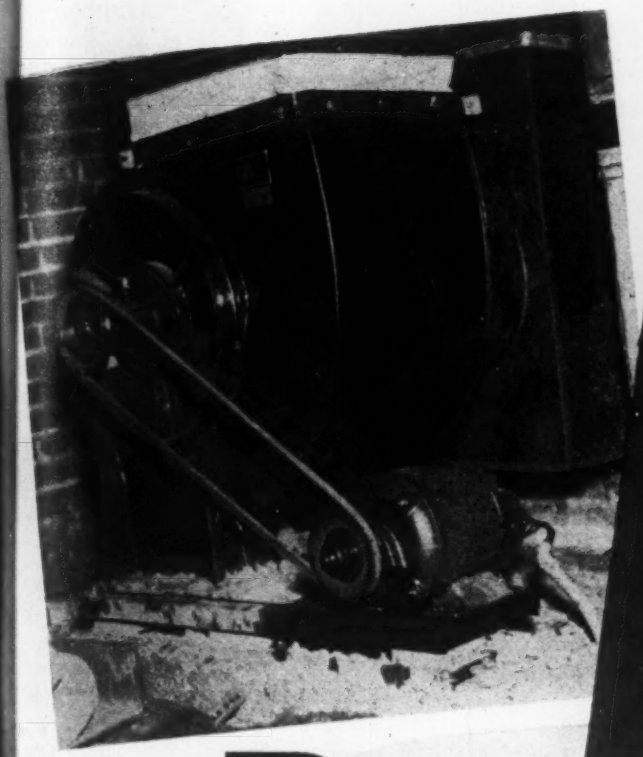
The dampener is stocked in three sizes (female connections on each end) ¼, ⅜ and ½ in., for pressure up to 6000 psi. It can be used on any gage line to boilers, engines, pumps, compressors, etc.

Year 'Round Air Conditioning Unit

No. 3211—A "Dual-Solution" air conditioning unit for cooling and dehumidifying in summer and for heating and humidifying in winter has been patented by F. H. Hibbard, Cooper Pl., Harrison, N. Y.**

During the cooling cycle, air is cooled and dehumidified by contact with a cooled and moderately strong hygroscopic solution. During the heating cycle, air is heated by extended surface tubes, within which warm solution is circulated, and is humidified by contact with a hygroscopic solution of controlled strength. Conditioned air temperature and humidity are independently controlled and the same equipment is employed to heat or to cool the air, using gas or oil fuel for both purposes.

According to the designer, the system is not under pressure, no refrigerant gas is used, and equipment such as fans, low head pumps, and float valves are the only moving parts. Lithium chloride solution has been used on tests of these absorption type units; however other solutions will also be tested. The equipment is said to operate with outstanding economy while cooling and to be the equal of other year-around type units while operating on the heating cycle. Energy consumption per ton of refrigeration per hr is given, for the double effect type, as 0.63 lb of fuel oil plus approximately 0.10 kwhr.



For quiet operation this blower installed in a hotel is driven by a Century ½ horsepower SC motor

Provide All the Comfort Your Equipment is Designed to Give—with Quiet Starting and Operating

CENTURY MOTORS

Century air conditioning motors contribute greatly to the comfort of air circulating and air cooling installations.

Century motors' unusual freedom from vibration — and quiet starting and running are the result of careful electrical and mechanical balancing, accurately machined bearings, rigid motor construction, and cushioned bearing bumpers that reduce the shock often caused by V-belt irregularity.

Many air conditioning and refrigeration manufacturers have standardized on Century motors to assure their customers the greatest air conditioning comfort for the longest period of time.

Century builds a complete line of motors from 1/20 to 600 horsepower to give smooth, quiet, dependable operation on compressors, blowers, fans, pumps, unit heaters and any other heating, cooling or air conditioning installation. Specify Century motors on all your electrically powered equipment.

Century C MOTORS

CENTURY ELECTRIC COMPANY, 1806 Pine St., St. Louis 3, Mo.

482

Offices and Stock Points in Principal Cities

Thread 1" to 2" pipe fast and easily with this direct-action

No. 1R RIDGID

You'll like the mistake-proof quick-setting workholder...

● Here's a poster threader that gives you new ease and speed in cutting clean threads on 1," 1¼," 1½" and 2" pipe. Workholder sets to size quickly: put on pipe, tighten 1 screw, no bushings. Full-floating posts only taper threads: positive wobble-proof threading action, handle to head to chasers. Alloy or high-speed steel dies, rugged steel-and-malleable construction for long service. It sells at a popular price, at your Supply House.

1R stands up handily on its own feet.

RIDGID

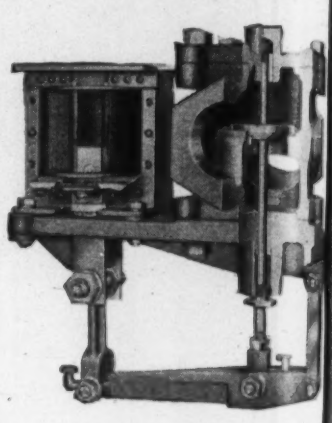
WORK-SAVER PIPE TOOLS

THE RIDGE TOOL COMPANY • ELYRIA, OHIO, U. S. A.

Direct Acting Solenoid Valve

No. 3212*—Designed for all types of liquid level control, and for use with hot and cold water, steam, oil, and other processing liquids, a new direct acting solenoid valve is offered by the Johnson Corp., 80 Wood St., Three Rivers, Mich.

A lever arrangement provides power to open the valve and, according to the manufacturer, the single seat construction permits the valve to be used for handling liquids or steam up to 365 F. The valve is designed for heavy duty service and is of the globe screwed type. The body may be obtained in cast iron or bronze and the trim is of stainless steel.



The unit is available in two series. Type "HH" for sizes from ½ to 1½ in., is suitable for pressures ranging from 125 to 150 psi. Type "HL", in sizes from 1 to 3 in., is for medium and low differential pressures. Standard models are furnished for operation on 110, 220, or 440 volt, 60 cycle current.

Axial Fan Assembly for Transportation Field

No. 3213—Production of an axial fan assembly as an individual unit for use in mobile heating, ventilating, and air conditioning systems has been announced by the Thermo-Aire Div., Evans Products Co., 1531 Fullerton, Detroit 27, Mich.**

Previously this fan assembly has been manufactured as a component part of the company's bus and truck heating and ventilating equipment. The airfoil fan, molded from a heat and damage resistant thermo-setting plastic, incorporates a straight wing section in its design.

It is designed for use where relatively large amounts of air circulation are needed and where installation space and the power source are limited. According to the manufacturer, the assembly uses 20 per cent less current than previous fans of this type, weighs 50 per cent less, and places 50 per cent less load on the motor bearings. The unit, which is available in sizes from 8 to 14 in. in diameter, is said to be suitable for a wide variety of air circulating systems including the cooling, heating, and ventilating of motor vehicles, railroad cars, and street cars.

The EXTRA VALUES You Receive from Pritchard Cooling Towers

Patented Pritchard SEALDFLOW fan drive over FEATHERWEIGHT (Monel metal) induced draft fan

result from

features like these

FANS extremely light in weight, requiring less power. True airfoil blades of corrosion-resisting wrought Monel welded to a rugged internal frame, with pitch adjustable to permit optimum setting for any tower loading. Other advantages worthy of examination.

DRIVES composed of integral vertical gearhead motors, eliminating right angle gears, flexible couplings and alignment problems. Write for complete information.

DISTRIBUTING SYSTEM that is the most lastingly trouble-free yet devised. All-redwood, capable of 100% overload with completely uniform water distribution. Get the full facts on its unique design.

AIR-INTAKE SYSTEM that applies sound and progressive engineering to air inlets, to the benefit of air distribution and the virtual elimination of winter troubles. 5 different arrangements available at same price. Let us give you the details.

STRUCTURAL STRENGTH that is second to none, employing more redwood and LESS corrodable iron and steel; skillful use of ample diagonals, ring connectors, angle washers, etc. The "fine points" of Pritchard construction merit your closer study

DECKING-that achieves ideal water break-up over its entire cubic area and remains permanently level.

DELIVERY DATES that carry the assurance, based on a consistent history, of completion promises and performance guarantees being met or bettered.

On all these points, and for towers of all sizes and types, Pritchard has an outstanding record to show you, worthy of your inquiry. Write or call the office near you.

EQUIPMENT DIVISION, Fidelity Bldg., Kansas City 6, Mo.

Pritchard EQUIPMENT

THE LINK TO BETTER PERFORMANCE

- "Airdfin" Air-Cooled Heat Exchangers
- Cooling Towers, All Types and Capacities
- Shell & Tube and Atmospheric Heat Exchangers
- "Hydryer" Air and Gas Drying Units
- "3-Zone" Cleaners and Separators for Air, Gas and Steam
- Air Treaters for Purification and Positive Control of Moisture and Temperature in Air Conditioning Systems

For more information, see Sweets Files, Chemical Engineering Catalog, Refinery Catalog, ASH&VE Guide or ASRE Data Book

NEW YORK, CHICAGO, LOS ANGELES, DETROIT, PITTSBURGH, ST. LOUIS, HOUSTON, TULSA, ST. PAUL, OMAHA, DENVER, ATLANTA, SALT LAKE CITY, EL PASO, MEXICO CITY

J.F. Pritchard & Co.

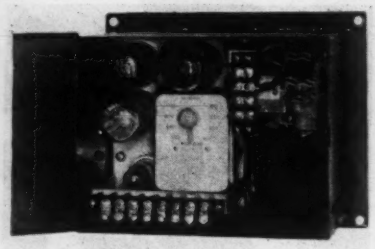
ENGINEERS • CONSTRUCTORS • MANUFACTURERS

for the CHEMICAL, PETROLEUM, GAS & POWER industries

Thermal Limit Switch

No. 3214*—Ashcroft Gauge Div., Manning, Maxwell & Moore, Inc., Bridgeport 2, Conn., announced a new thermocouple-actuated limit switch.

As an example of its use, the manufacturer states that protection is required in air ducts on industrial ovens, dryers, bearings of large motors, blower wheels, flue gas stacks of boilers, plastic injection presses, reheaters, etc. The temperature chosen as the high limit is set by an operating knob located inside the case. If this temperature is reached, the device will stop the apparatus before excessive damage is done, or it can be arranged to sound an alarm or operate a light. If desired, either or all of these functions can be performed at the same time. The device, which is provided with a manual reset, will "fail safe" in case of burning off or breaking of the thermocouple, failure of power supply, tube, or mercury switch.



The thermal protector is designed with two ranges, 100 to 1000 F using an IC couple, and 800 to 2000 F using an AC couple with an accuracy of 2 per cent of the range at a set point. Two or more couples may be connected, in series if desired. The cold junction is located in the unit and is compensated to ambient temperatures of 50 to 135 F and a relative humidity up to 100 per cent.

The current characteristics are 115-230 volts, 60 cycle a-c, 15-20 watts. There are no open contacts in the device and the circuit for the signal and power input to the apparatus is a standard 4 amp, 250 volt mercury switch.

Low Temperature Silver Brazing Alloys

No. 3215—Two new silver brazing alloys, "Easy-Flo 45" and "Easy-Flo 35", have been announced by Handy & Harman, 82 Fulton St., New York, N. Y.

The 45 per cent silver alloy also contains copper, zinc, and cadmium and one of its exceptional features is said to be its low melting range, 1120-1145 F. The manufacturer states that the joints produced between ferrous, nonferrous, and dissimilar metals are strong, ductile, and leak-tight. It is said to offer the advantages of alloys with a higher silver content at a lower cost.

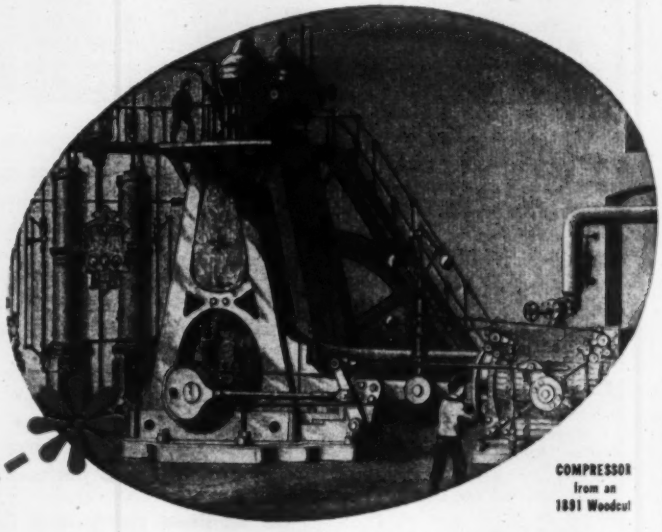
The 35 per cent alloy has a wider melting range, 1115-1295 F. and is said to be free flowing at a relatively low temperature range. It is offered for producing joints which are high in strength and ductility and for use in cases where a higher working temperature is not objectionable.

PROGRESS

The Rube Goldberg contraption at the right is, believe it or not, a compressor (circa 1891). Note the comparative size of the men.

Below, for comparison, is Baker's popular F6B Compressor, approximately one-hundredth the size of the inefficient Goliath above. That's progress!

But that's just the beginning. Right now Baker is engineering new products which will again raise the standards of the entire refrigeration industry. Watch Baker for progress. Expect big things.



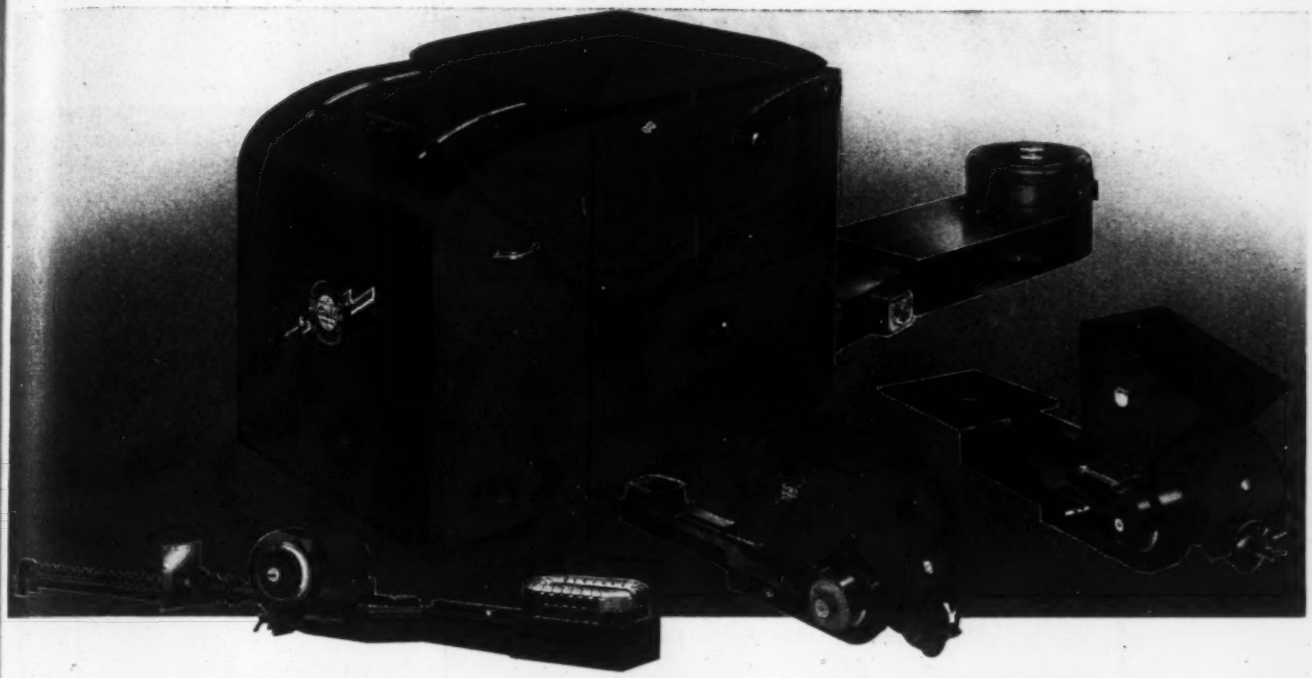
COMPRESSOR from an 1891 Woodcut

BAKER Model F6B Compressor

Baker

ICE MACHINE COMPANY, INC., OMAHA

MANUFACTURERS OF REFRIGERATION AND AIR CONDITIONING EQUIPMENT SINCE 1905



WHERE THERE'S A WINKLER THERE'S A SATISFIED OWNER

NO SERVICE CALLS

This owner says, "*My Winkler has performed perfectly and has not required a single service call. I think your automatic transmission, which does not have a shear pin, is worth more by itself than any other complete stoker.*"

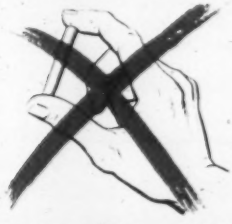
CUTS FUEL BILL 56%

Owner writes, "*We have reduced our annual fuel bill from approximately $3650 to less than $1600, which is more than you promised us. We will be glad to recommend the Winkler to anyone interested.*"

In residential, commercial and industrial installations the country over, Winkler performance is making thousands of boosters

Certainly the man who operates a stoker is the best judge of its value. So when innumerable Winkler owners take the trouble to tell us that a Winkler is a highly profitable investment, that's pretty sound proof that this stoker really delivers.

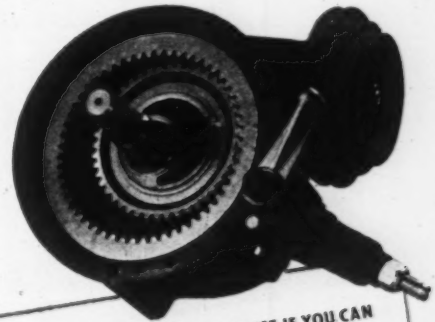
Why do Winklers make outstanding performance records? *Simply because their superior design and rugged construction develop the inherent benefits of stoker firing to the utmost!* From the moment coal leaves the hopper or bin, it is handled in a manner which assures full utilization of its heat content. Not only does a Winkler operate with top efficiency, but it is built to stand up under years of hard service.



Fully automatic transmission —no shear pin!

The exclusive Winkler "Inter-Plan" transmission develops *extra power* to handle operating overloads. Protection against damage which might be caused by a blocked feed screw is provided by the Winkler Safety Release, which automatically disconnects the transmission until the blocking object is removed. The Winkler then resumes operation, *with no shear pin to replace!*

The net result is that a Winkler returns to its owner a large saving in money and labor, plus an all around improvement in heating plant operation.



MATCH THE WINKLER FRANCHISE IF YOU CAN

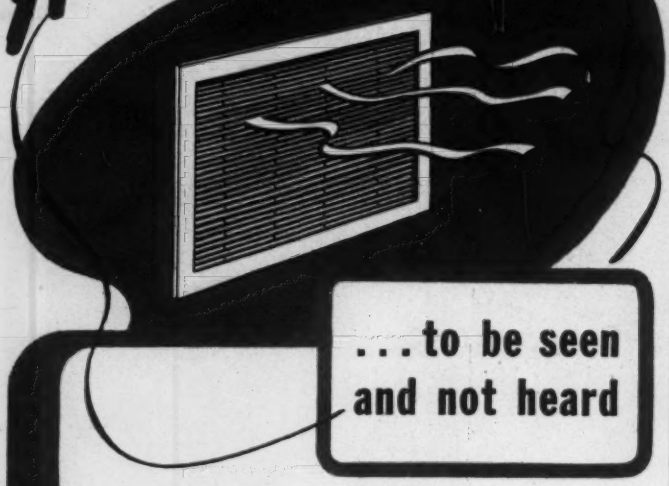
The Winkler Franchise is not a mere authorization to distribute Winkler Stokers—it actually sets you up for success! It provides for complete training in proved methods of profitable stoker merchandising . . . physical equipment for selling . . . and participation in the Winkler Two-for-One Advertising Bonus Plan. Write for information.

WINKLER

fully automatic STOKERS

U. S. MACHINE CORPORATION • Dept. S-11 • Lebanon, Indiana

AIR CONDITIONING



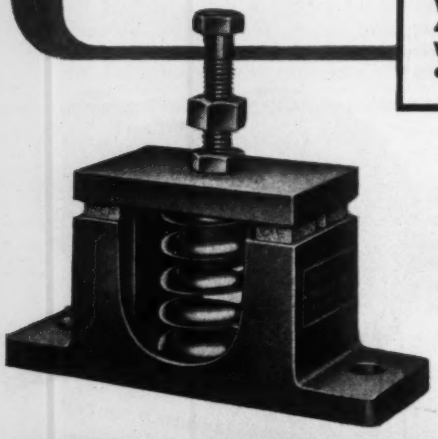
. . . to be seen and not heard

When you need ribbons on the ducts to show your air conditioning in operation —then noise and vibration have successfully been eliminated.

And Korfund Vibration Control assures you of this important benefit. Engineered especially for your needs, Vibration Control prevents disturbance caused by machinery in motion.

Korfund designs Vibration Control for fans, blowers, compressors and for complete units. For really satisfactory air conditioning—the kind that takes ribbons —consult Korfund for Engineered Vibration Control.

The Korfund Co., Inc., is sole distributor of Armstrong Standard Density Vibracork in 2" to 4" thicknesses. Write for complete details.



Korfund Type LK/C is an inexpensive steel spring Vibro-Isolator with resilient chocks at the corners to act as stabilizers.

KORFUND
VIBRATION CONTROL

THE KORFUND COMPANY, Inc., 48-36 32nd Pl. LONG ISLAND CITY 1, NEW YORK

Scientific Instrument Manufacturer to Expand

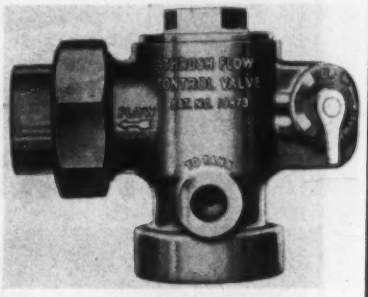
No. 3216—Plans for a general expansion of the Ray Control Co., 975 E. Green St., Pasadena, Calif., emphasize the exploration of possibilities in spectroscopy, including electronic recording, and other scientific fields.**

The company manufactured various types of lenses, prisms, optical elements, and instruments for the navy during the war, and is a wholly owned subsidiary of Lane-Wells Co. E. B. Evleth, formerly vice president and general manager of Brown Instrument Co., has been named president.

Improved Flow Control Valve

No. 3217—An improved flow control valve for hot water heating systems has been announced by H. A. Thrush & Co., Peru, Ind.

A tapping is provided beneath the seat of the valve for connection to the pressure tank. This, says the manufacturer, is necessary because air and gases are liberated when the water is at a high temperature and when the valve is closed. The check valve is of the horizontal seat type with a free working disk. A union is provided on the outlet side and a lever is provided for manually opening the valve to obtain gravity circulation or to completely drain the system.

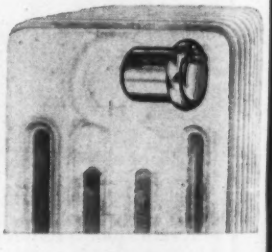


This new and improved design is made in 1, 1¼, 1½ and 2 in. sizes.

Air Valve for Hot Water Radiators

No. 3218—A new automatic air valve for hot water radiators, convectors, and panel radiation has been announced by Maid-O'-Mist, Inc., 3217 N. Pulaski Rd., Chicago 41, Ill.

The valve, designated as No. 27 "Auto-Vent," is designed to relieve air from trapped hot water radiators, pipe lines, etc., and is recommended for installations on all free standing radiators, baseboard radiation, and convectors without the use of air chambers where pressures do not exceed 50 lb.



The valve, 2½ in. long x 2 in. in diameter is constructed of brass with nickel plated finish, has a monel metal bearing and levers, and is equipped with a monel metal spring and neoprene valve seat.

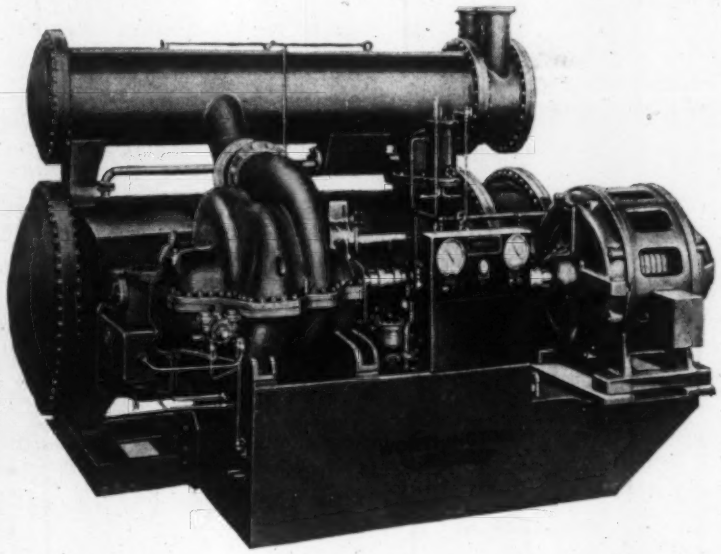
Industrial Cement

No. 3219—"Sumtex" cement, used for joining metal surfaces, sealing machine threaded joints, gaskets, and leak-proof assemblies, is now being distributed by the Warehouse Point Co., Warehouse Point, Conn.**

WORTHINGTON

Air Conditioning and Refrigeration Report

Worthington Pump & Machinery Corporation, Harrison, New Jersey



WORTHINGTON CENTRIFUGAL REFRIGERATION SERVES INDUSTRY IN MANY IMPORTANT WAYS

The applications of Worthington Centrifugal Refrigeration are many and varied. Chilling water for air conditioning; chilling water or brine for industrial processes; cooling chemical and other liquids; maintaining constant temperatures in testing rooms — these are but a few of its commoner uses. In addition, its large-volume compressors are well suited for producing ultra-low temperatures for technical research.

A system consists essentially of compressor, condenser and evaporator. Worthington manufactures these in their entirety, from foundry to finished product. For steam-turbine-driven units, Worthington also makes the turbine, as well as many other auxiliaries vital to a complete refrigeration plant. Rarely does the purchaser have such an opportunity to fix responsibility for a system's over-all operation on a single manufacturer.

Worthington Centrifugal Refrigeration Systems, in capacities ranging from 150 to 2600 tons, combine minimum floor space requirements with maximum accessibility. Their rugged construction, advanced design and outstanding efficiency assure many years of dependable, low-cost refrigeration.

Worthington Pump and Machinery Corporation, Harrison, N. J. Specialists in air conditioning and refrigeration for more than 50 years.

A8-14

WORTHINGTON

Air Conditioning and Refrigeration

Noted Western Hotel Adds Worthington Air Conditioning

The popular Adams Hotel in Phoenix, Arizona, follows today's trend by installing a Worthington centrifugal refrigeration unit for air conditioning. In assuring its guests of healthful, comfortable air the year round, this modern hotel joins a large and growing list of famous hostelries now using Worthington equipment.

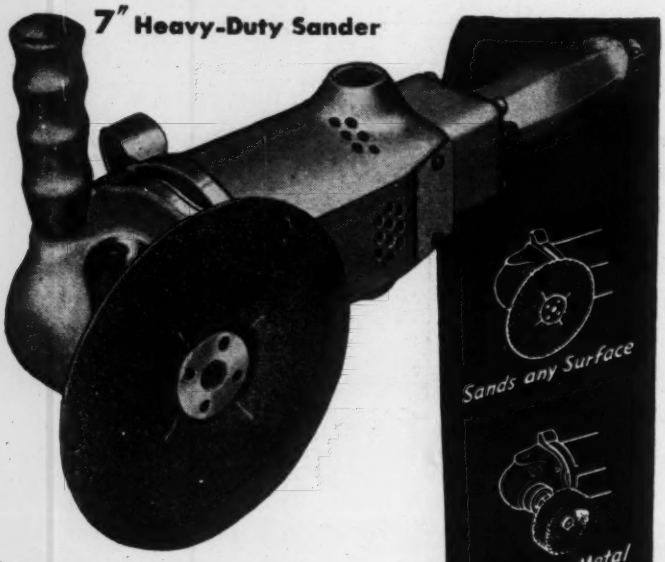
"Packaged Air Conditioning" for Smaller Business Spaces

Worthington Self-Contained Air Conditioners, Model SYC, are ideal for smaller stores, shops, offices. Two sizes: 3-ton and 5-ton refrigeration capacities. For year 'round supply of fresh, clean invigorating air — cooled in summer and heated in winter. A competitive necessity . . . and another good reason why *there's more worth in Worthington.*

Look To Worthington for "Integrated" Systems

As makers of so many of the "inner vitals" of an air-conditioning or refrigeration system — compressors, condensers, pumps, turbines, valves, fittings, etc. — Worthington is your logical source for an "integrated" system to give you efficient, economical, trouble-free service. Your nearby Worthington Distributor will gladly supply full details.

7" Heavy-Duty Sander



Sands any Surface

Grinds any Metal

Speeds Wire Brushing

Semi-Finishes Lumber

Shapes All Timbers

Surfaces Stone, Tile

This One POWER TOOL Does All••

A Black & Decker Portable Electric Sander drives many attachments . . . does many fabrication and installation jobs . . . on all types of heating, piping and air conditioning work. Available attachments include:

WIRE CUP BRUSHES for removing rust, old paint, scale, light weld spatter, oxidation, grease or tar.

ABRASIVE DISCS in 19 different grains, for sanding and smoothing any surface.

GRINDING WHEELS for smoothing welds and castings, surfacing concrete, stone or tile.

ROTARY PLANER HEADS for shaping and semi-finishing lumber—jobs formerly done with jack plane and adz.

Order now from your Black & Decker Distributor, or write to: The Black & Decker Mfg. Co., 628 Penna. Ave., Towson 4, Md.

LEADING DISTRIBUTORS EVERYWHERE SELL

Black & Decker

PORTABLE ELECTRIC TOOLS

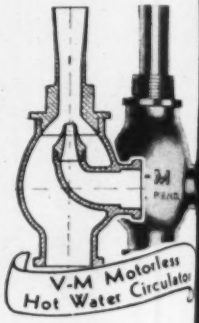
ELECTRIC DRILLS ELECTRIC SHEARS BENCH GRINDERS WIRE BRUSHES

The manufacturer, Summit Paint & Varnish Co., states that this product is not affected by high pressures, oils, acids, or water, and that it is noninjurious to metals. It is also said that it will not settle and is highly resistant to humidity and temperature extremes. Many miscellaneous and nonindustrial uses have been found for this cement. For example, it has been used successfully in attaching sponge rubber gasketing to metal surfaces.

Venturi Type Hot Water Circulator

No. 3220—The V-M Sales Co., 201 N. Wells St., Chicago, Ill., has been formed to market a venturi type circulator for use in storage type, recirculating hot water systems.**

One connection of this fitting receives incoming cold water to the system while the second leads into the hot water tank in the usual manner. The third connection brings hot or warm water from the system into contact with the incoming cold water. According to the manufacturer, the device maintains uniform temperatures throughout the system and storage tank. This is said to provide more hot water from a given size tank and to eliminate stratification which wastes both fuel and storage space.

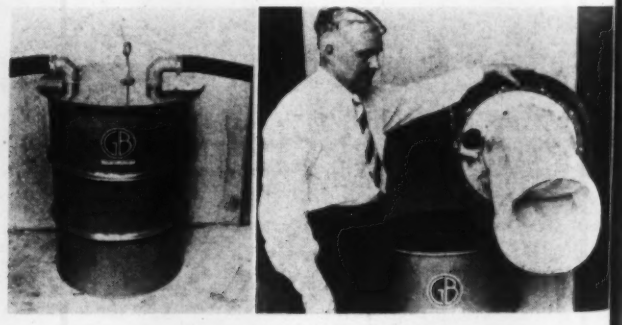


V-M Motorless Hot Water Circulator

Industrial Vacuum Cleaning Unit

No. 3221—A new industrial vacuum cleaning unit, "The General Insulation Vac," has recently been announced by General Blower Co., 8065 Ferris, Morton Grove, Ill.

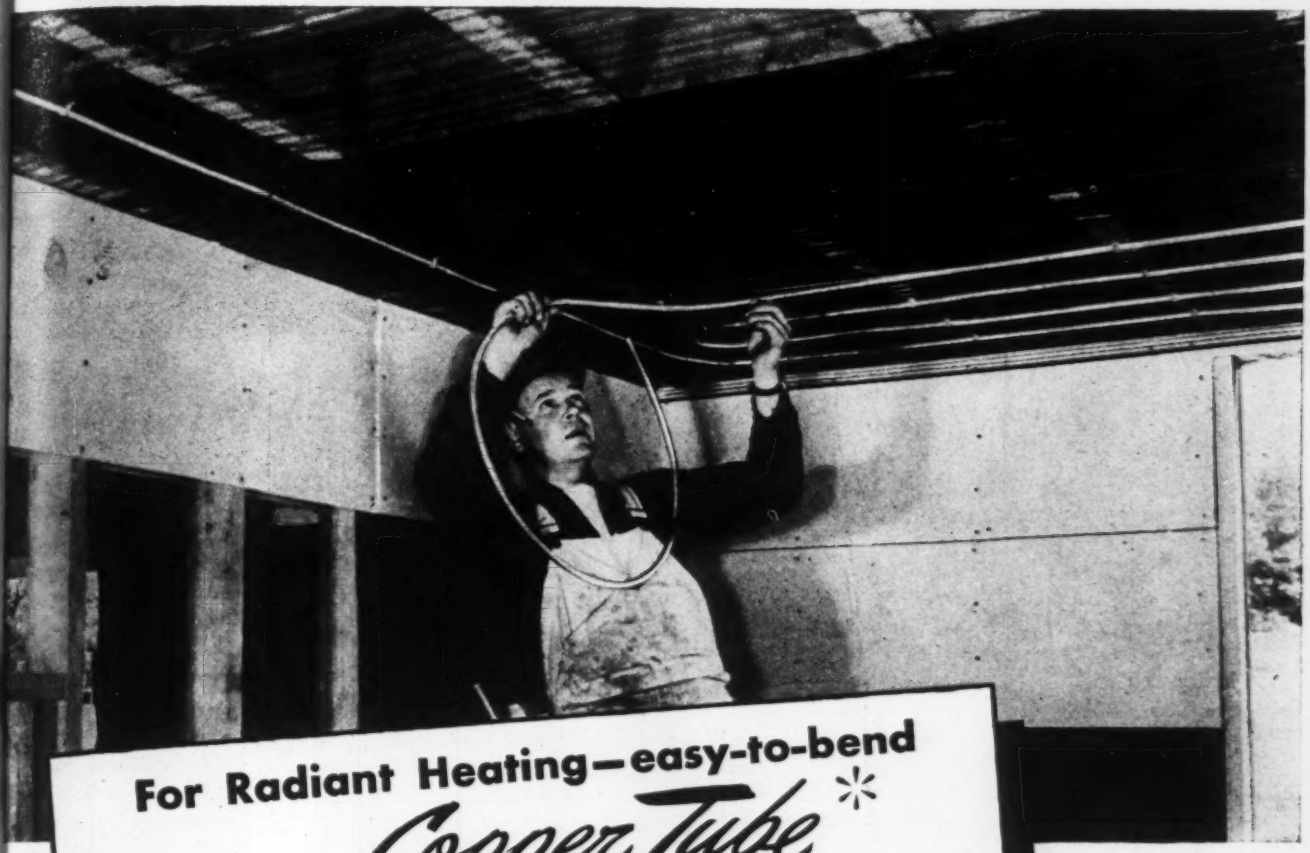
The vacuum unit consists of a metal vacuum tank, a double hose connection, a filter bag, and an agitating plunger. Power is provided by attaching one of the hose connections to the inlet of the company's blowing machine. In this way the blowing mechanism can be made to perform a dual function, becoming a vacuum



cleaning unit as well as an insulation blowing machine. The device may be used to pick up loose material such as nails, sand, gravel, plaster, debris, shavings, sawdust, insulation waste, etc. It is designed for more rapid clean-up of shops, trucks, flues, and many other items of equipment.

Pressure Switches

No. 3222—Three new pressure switches are now in quantity production at the plant of Cook Electric Co., 1457 Diversey Parkway, Chicago 14, Ill.



For Radiant Heating—easy-to-bend *Copper Tube* *

DOWN the length of the panel goes the pipe and then—a bend. Now bring it back—another *bend*. Down again, and *bend*...Two hundred times or more, in many installations, pipe must be bent to form the panel coils of a radiant heating system.

Here's where soft copper tube can save you construction time. It's flexible—can be bent easily. With copper tube, smaller diameters (½ and ⅜ inch nominal) may be used. And the more bends the fewer fittings.

But *flexibility* is just one of many advantages of Chase Copper Tube in radiant heating. Note, in the list at right, some of the others: soldered fittings (leak-proof connections); light weight (a saving in transportation and handling costs); long life (copper is *resistant* to corrosion).

The demand for Chase Copper Water Tube is so great that we are not able to satisfy it at all times. However the technical information is now available to you for future planning. Before you tackle that next radiant heating contract, send for our new book, "Chase Copper Tube for Radiant Heating." Simply address Dept. HPA-86.

7 Reasons
WHY CHASE COPPER TUBE FOR RADIANT HEATING

* 1. EASY TO BEND
2. LIGHT IN WEIGHT
3. SOLDERED FITTINGS
4. SMALL DIAMETERS
5. LONG LENGTHS
6. LOW COST
7. LONG LIFE

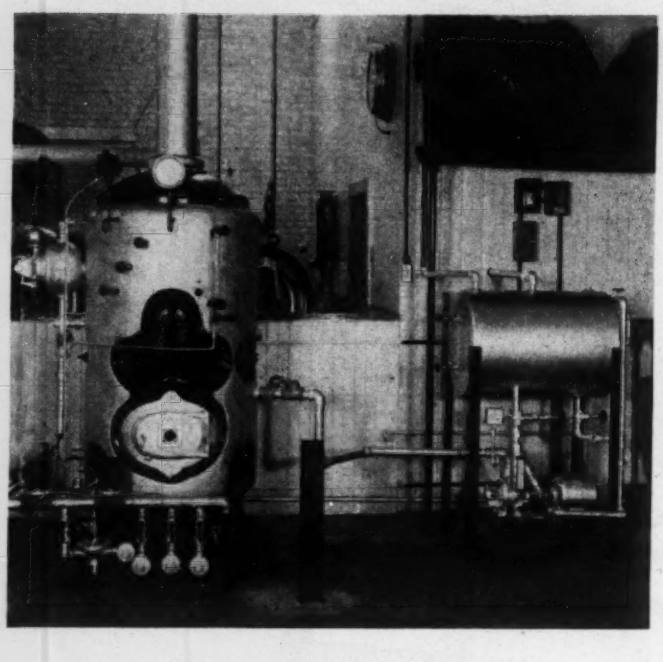
Chase
BRASS & COPPER CO.
INCORPORATED
Waterbury 91, Connecticut
SUBSIDIARY OF KENNECOTT COPPER CORPORATION

This is the Chase Network—handiest way to buy brass

ALBANY† ATLANTA† BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DETROIT HOUSTON† INDIANAPOLIS JACKSONVILLE† KANSAS CITY, MO. LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER† SAN FRANCISCO SEATTLE ST. LOUIS WASHINGTON† (†Indicates Sales Office Only)

Heating Contractors:

McKee Works With You to "Condense Costs"



McKee 8 H.P. Type 3-A Boiler and "Save Condensation" unit condenses costs in this Tire Re-capping Shop.

McKee "STEAMBOILERPLANTS"

McKee has the experience *plus the right equipment* to help you "Condense Costs" on each job.

A McKee "Steamboilerplant" System is shipped complete from the factory, ready to install; just connect to the gas, water and supply lines. There are no "extras". The entire plant is McKee, with full responsibility for satisfactory performance resting with us.

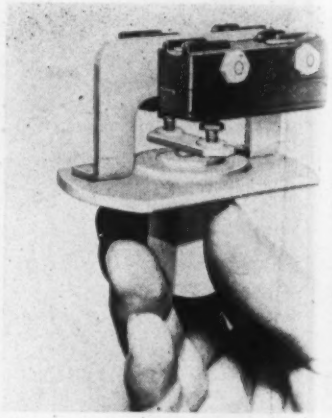
McKee Eclipse

ECLIPSE FUEL ENGINEERING CO.

767 SO. MAIN STREET • ROCKFORD, ILLINOIS

Engineers in all principal cities

Operating range of these switches is from 30 in. vacuum to 17 psi. Maximum current capacity is 10 amp at 120 volts, a-c. The bellows diaphragm is constructed of tinned phosphor bronze. Shown here is the company's industrial differential pressure switch which may be used for two independent circuits at two selected pressures which may or may not be equal. According to the manufacturer, this line of low cost pressure switches will serve a wide range of applications in the fields of air conditioning, refrigeration, heating, chemical processes, and in many industries.



Furnace Manufacturer Expands

No. 3223—An expansion program designed to increase the company's manufacturing facilities has been announced by Jackson & Church Co., Furnace Div., Saginaw, Mich.

A new plant of approximately 40,000 sq ft, located at nearby Carrollton, will be used for manufacturing furnace cabinets, receiving and shipping furnaces and other equipment.

Direct Fired Air Heater

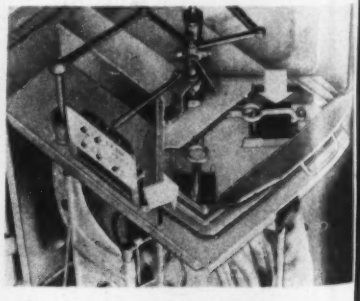
No. 3224 — The "Weathertherm" direct fired heater, designed for use with coal, gas, or oil, is offered by Weatherall Engineers, Inc., 3 Friendship St., Providence, R. I.**

These steel heaters, which are available in sizes from 75 thousand to 5 million Btu per hr output, are of all welded construction. A feature of the units is said to be the use of diagonal air heating tubes which are made of seamless boiler tubing.

Gas Meter Valve

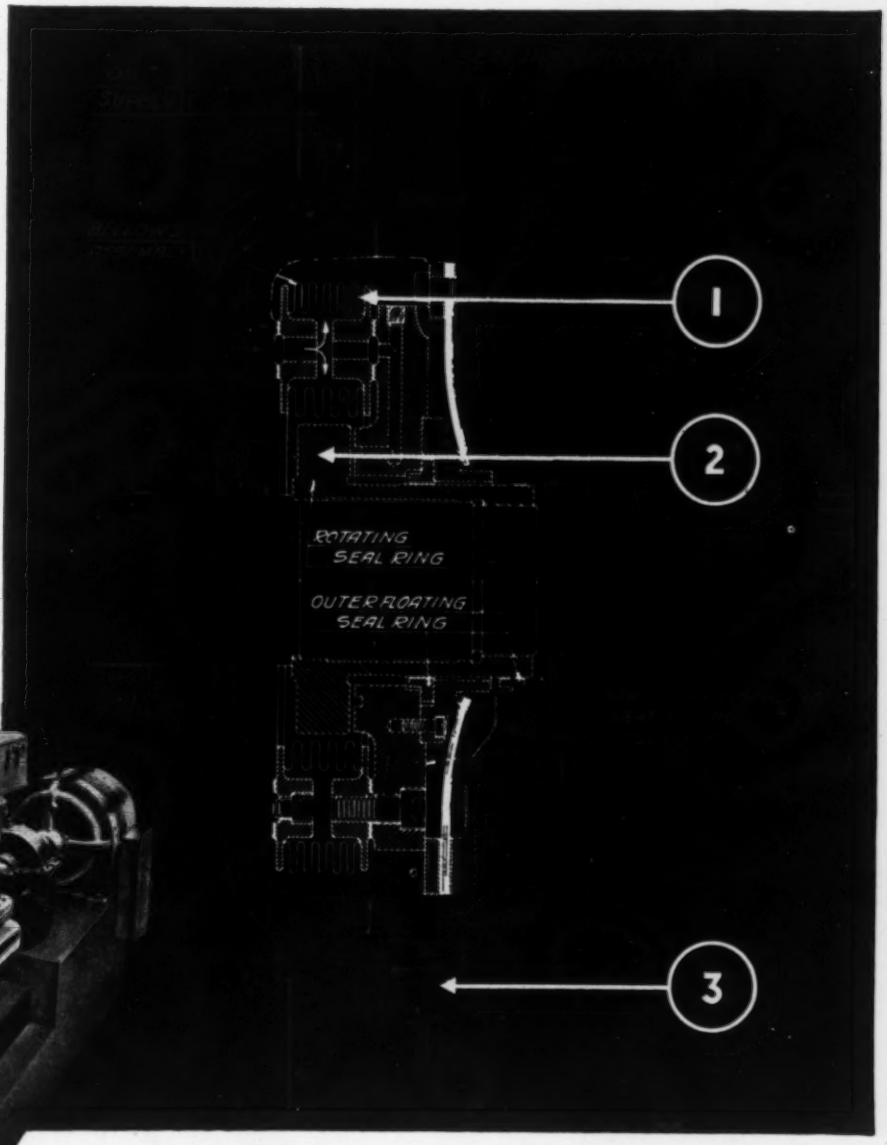
No. 3225—The "No-Drag" valve of carbon-graphite is offered by Morganite Inc., 3304 48th Ave., Long Island City 1, N. Y., for use in gas meters.

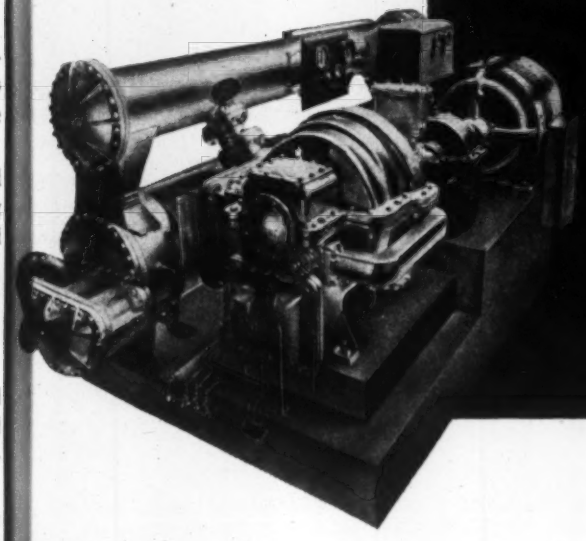
The self-lubricating characteristics of the valve are said to provide long life, resistance to chemical attack, dimensional stability, quiet operation, and freedom from gumming, sticking, and warping.



Valves are available in slide or circular motion types for all makes of meters.

This Carrier Seal's a dollar saver





THE centrifugal refrigerating machine pioneered by Carrier has the money-saving advantages of a positive, simple, fully automatic seal *without surface contact* while in operation. This seal—of revolutionary Carrier design—saves thousands of dollars in refrigerant losses . . . reduces corrosion and power loss by keeping out moisture and air.

The passage of refrigerant and air along the high-speed shaft is prevented by a pressure oil film. This oil holds the seal faces apart when the compressor is operating, making metal-to-metal contact impossible. By the elimination of surface wear the seal is assured long life and perfect adjustment. Maintenance costs are kept at a minimum.

The dollar-saving Carrier seal—like the centrifugal itself—is the product of the most experienced engineering staff in the whole field of air conditioning and refrigeration. You can count on Carrier centrifugal refrigeration units. They're designed and built to deliver years of uninterrupted service. That's been proved by 25 years' successful operation. Carrier Corporation, Syracuse, New York.

1. Oil under pressure forces seal faces apart when compressor is operating. This forms an effective seal against loss of refrigerant and admission of air and water, prevents wear due to metal-to-metal contact. Thin oil film is maintained between stationary and rotating seal face during shutdown periods. Seal is supplied continuously with clean oil. Both strainer and cloth filters remove all impurities, extending seal life.

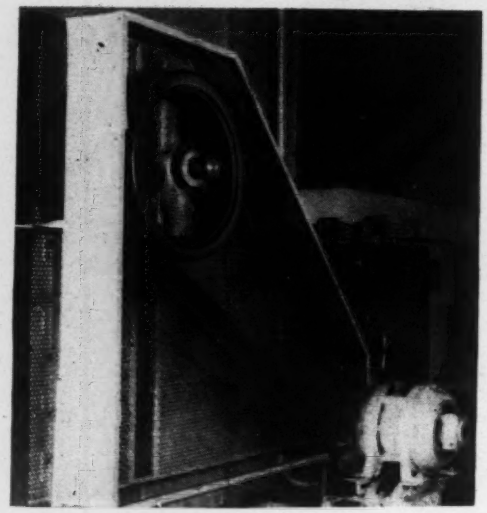
2. Fatigue of metal bellows is overcome by design of seal. Bellows move to a fixed position when compressor is starting or stopping and are not subject to the movements of shaft and rotating seal faces.

3. Inspection is fast and simple. Removal of six nuts gives access to seal.

Carrier

AIR CONDITIONING
REFRIGERATION
INDUSTRIAL HEATING

GET MORE PRODUCTION



with the

EFFICIENT ECONOMICAL

Tannate-Rockwood

SHORT CENTER DRIVE

Here is a consistent, dependable drive that keeps production flowing, steadily and at a fast pace.

Efficient . . . CORRECT belt tension is maintained at all times and under any load condition, by the weight of the motor on the pivoted Rockwood base. Maximum power is delivered without undue strain on belt and bearings.

The TANNATE belt hugs pulleys with a firm grip. TANNATE is TOUGH with a strength one-third to one-half greater than choice oak belting. And TANNATE keeps this tenacious pulley grip day in and day out through a long service life, with practically no maintenance needed.

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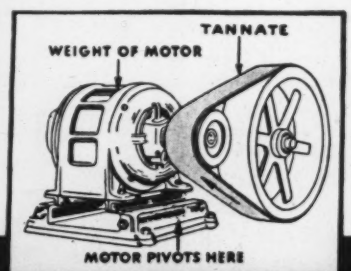

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NEW BOOKS & REPORTS

ASRE Publishes Data on Refrigeration in Meat Packing Plants

The application of mechanical refrigeration to meat packing plants, together with tabular data relating to this subject, is contained in Application Data Section No. 36 issued by the American Society of Refrigerating Engineers, 40 W. 40th St., New York 18, N. Y.

The purpose of this concise pamphlet is to indicate the principal facilities used in meat packing plants with their methods of operation, and to present the most favorable refrigeration methods with the generally accepted temperature and humidity values. In addition, there is presented information pertaining to refrigerated spaces and miscellaneous packing house data that should prove valuable to anyone interested in designing or installing refrigeration equipment for meat packing plants.

The course of the carcass is traced from the killing through the rendering processes, including the disposition of the various edible and inedible products and by-products. Sketches are included showing the air flow and brine spray over the suspended carcasses, location of pipe coils, air ducts, and also floor plans of a two story, medium size meat packing plant.

A full page table gives the range of temperature and humidity generally used by the industry for beef and hogs in their various stages of processing as well as for various by-products, including sliced bacon, canned ham, sausage, lard, oleo, smoked meats, and salted hides.

The circular was prepared by Roger Sprague, chairman of the ASRE technical committee on meats and meat packing, assisted by the members of the committee.

Recommended Standards for Testing and Rating Convectors Sent to Trade

Mimeographed copies of the Recommended Commercial Standard for Testing and Rating Convectors, TS-4169, have been sent to manufacturers, representative distributors, users, and testing organizations by the U. S. Department of Commerce, National Bureau of Standards. Pursuant to a request from the joint convector code committee of the Convector Manufacturers Association and the Institute of Boiler and Radiator Manufacturers, a proposed draft of this standard was circulated in 1945 to various manufacturers, distributors, users, and testing organizations. Favorable comment and suggested changes were received from the trade with the result that this revised standard has been circulated for written acceptance in order that it may become more widely effective through establishment as a commercial standard and publication by the Department of Commerce.

The purpose of this commercial standard is to establish uniform methods of test for output of convectors in terms of the condensation capacity of steam convectors and the water heat capacity of hot water units, together with methods for determining, designating and guaranteeing convector ratings. Definitions, re-

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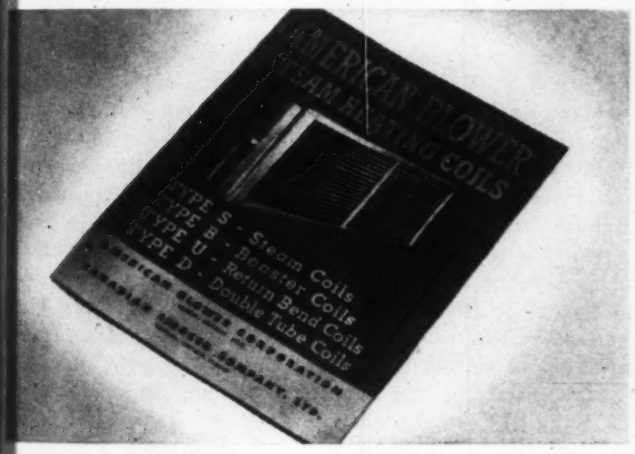
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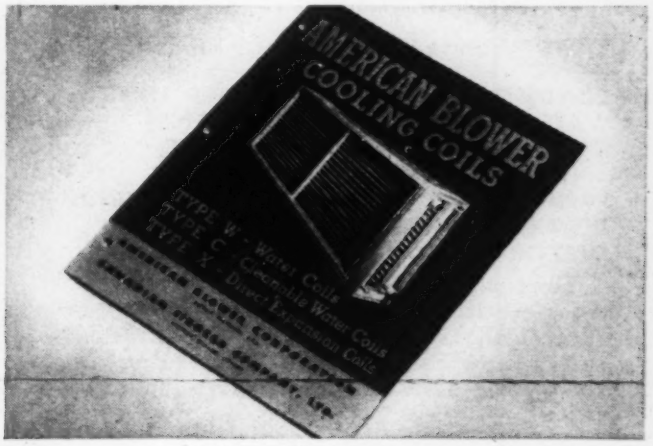

2 After you've taken Step 1, we know you'll send for these 2 bulletins—complete, convenient, easily understood guides to the selection and use of heating and cooling coils for every industrial need. American Blower engineers have assembled 56 pages of *authoritative* information on heating coils and 48 pages of invaluable cooling coil data. This wealth of information is now available to you in a compact, easy-to-use form. If you have problems in the selection, sizing or installation of coils, you will find these bulletins to be complete handbooks on the subject. Phone or write the nearest American Blower Branch for your copies of Bulletins B-1218 and 1521.

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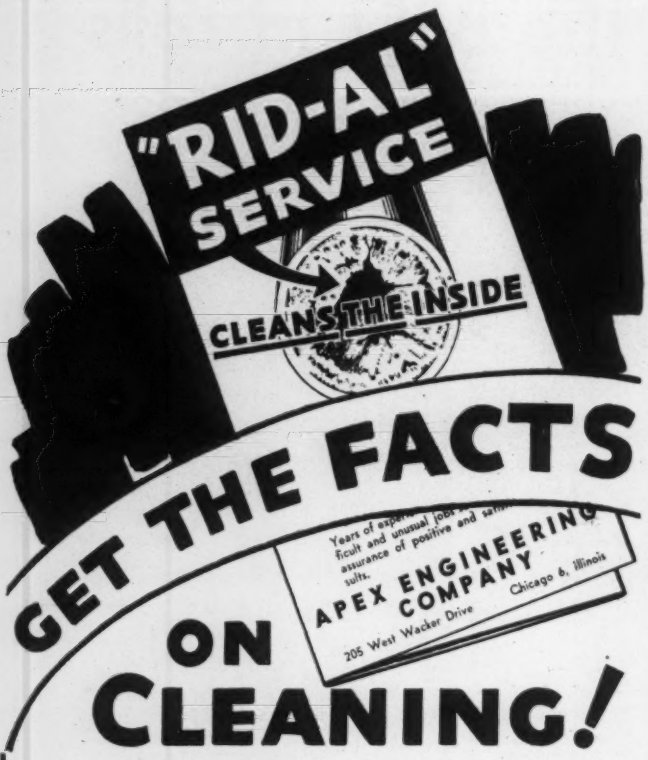

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quirements, and methods of testing and rating cast iron and nonferrous steam and hot water units are covered. A uniform method of guaranteeing compliance with the standard and a means for checking ratings for approval is given.

Additional Data Published on Atmospheric Conditions in Australian Textile Mills

The Australian textile industry employs 50,000 workers, is among the country's oldest, and is one with 20 million pounds capital. Certainly the question of future activity in the face of world competition is of vital concern to both management and workers. To many in the industry, who have given serious thought to the question, it is clear that without the best that can be obtained in output per man-hour, Australian mills will not meet world-wide competition. As in any industry, a reasonable maximum output is essential to a high level of employment and a rising standard of living. Inasmuch as the need for control of atmospheric conditions, both from the standpoint of process work and the health and productivity of the workers, has long been recognized, industrial scientists carried out tests of atmospheric conditions in 67 Australian mills which covered cotton, woolen, worsted, and silk spinning and weaving. The investigations extended over 15 months so that conditions could be studied in all seasons of the year.

The data collected and the conclusions reached have been published by the industrial welfare division, department of labour and national service, Commonwealth of Australia, in its bulletin No. 6, Atmospheric Conditions in Australian Textile Mills (for a discussion of this booklet see pp. 194-195, July 1946, HPAC). In a later bulletin, No. 7, Australian Textile Mills, a Guide to Good Working Conditions, the findings are briefly reviewed and a more complete discussion of what can be done to produce atmospheric conditions satisfactory to both the process and the comfort and efficiency of the workers is included. The report emphasizes the fact that there are no processes for which the atmospheric requirements of both the employees and that required for manipulation of fibers cannot be met. This second report contains more illustrations and stresses, in more detail, the importance of air movement up to 150 fpm, the introduction of outside air (30 cfm per person recommended), various means of reducing the cooling load, and what can be accomplished with both natural and mechanical ventilation. Air washers for providing humidification, the use of refrigeration, and control of dust and lint are also discussed.

Issues Commercial Standard for Mineral Wool Insulation

The latest development in the joint standardization program of the National Bureau of Standards and the Industrial Mineral Wool Institute is the release of Commercial Standard CS-131-46 on testing and reporting of all forms of mineral wool insulation, widely used by both steam power plants and manufacturers of electrical heating, and refrigeration equipment.

Odor emission, moisture adsorption, and compressive strength, in addition to the basic feature of thermal conductivity, are among tested characteristics of importance to the air conditioning industry. The new standard is designed to permit industry-wide bases of judg

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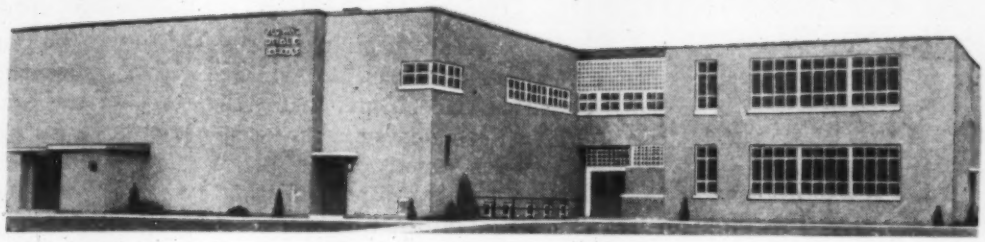
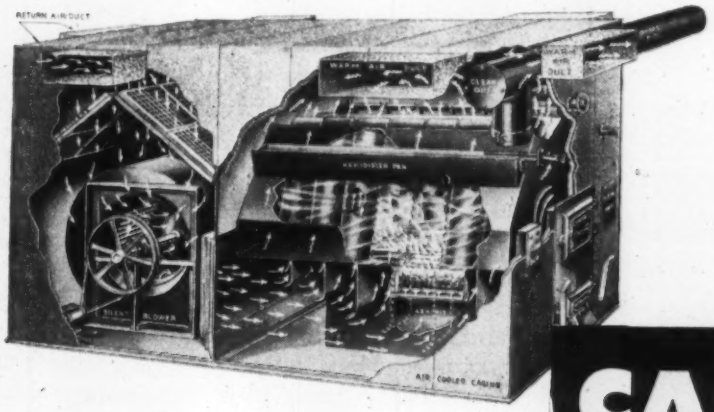


Klemme, Iowa, School. Thorwald Thorsen, Architect. This two-story school building is warm air heated with a Campbell 8000 Series Heater.

THE Campbell Heater in the School building illustrated above is one of many installations in which Campbell Warm Air Units have been used in large multiple-room structures. In all these installations, Campbell 8000 Series Heaters have provided abundant heat with outstanding fuel economy — plus the extra warm air advantages of fast heat delivery, positive control, and year 'round air conditioning.



Campbell 8000 Series Heaters are available for hand or stoker coal firing, gas or oil, in capacities ranging from 725,000 to 2,160,000 B.T.U.'s per hour.

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— FOR AIR CONDITIONING — REFRIGERATION — HEATING

ment and specification in mineral wool products. The tests described cover all material of fibrous form processed from molten rock, slag, or glass.

The forms of industrial mineral wool for which test methods are given are blanket, block, board, felt, granulated, industrial batt, insulating cement, loose, and pipe insulation of both blanket and molded forms. Uniform and detailed methods of testing and recording physical and chemical properties are given. The forms of industrial mineral wool are defined and formulas given for fixing the conclusive factor of each test.

The test for adhesive strength of insulating cement is based on the power required to separate two metal elements of prescribed size which have been bound together with a layer of insulating cement. The formula gives a result in pounds per square inch. The test for compressive strength applies to block, board, and insulating cement, and as in the preceding test, gives a result in pounds per square inch of compressive strength. Corrosion resistance is tested for all types of industrial mineral wool except insulating cement. It is based on the relative effect on identical steel plates—one freely exposed to humidity, and the other protected between specimens of mineral wool material. The coverage test applies to insulating cement only. The formulas express wet and dry coverage in square feet 1 in. thick per 100 lb of cement, volume change upon drying, and dry density.

Density and thickness tests are established for industrial batt, blanket, felt, and blanket type insulation. By different methods, the same tests are made for block and board insulation and for molded pipe insulation. The fire resistance test is made with a large bunsen burner on all mineral wool products in order to classify the materials as (1) incombustible, (2) fire retardant, (3) slow burning, or (4) combustible.

Moisture adsorption tests are described for all mineral wool products except insulating cement (which is applied wet to equipment operated at relatively high temperatures), the results showing as percentage of adsorption by weight and by volume.

A test for odor is included for the benefit of users in the low-temperature field. Tests for shot content (non-fibrous content) are specified for industrial batt, blanket, felt, granulated, loose, and blanket type pipe insulation.

Several of the tests established are based on methods adopted as standard by the American Society for Testing Materials. Others have been worked out by the specifications committee of the Industrial Mineral Wool Institute. Copies of the standard are available for distribution and can be secured from the Industrial Mineral Wool Institute, 441 Lexington Ave., New York 17, N. Y.

Radiation Requirements Tabulated

Tables showing the square feet of steam and hot water radiation required for rooms ranging in size from 5 x 5 ft to 20 x 30 ft are presented in the Beacon Radiation Reference Book and Heat Loss Guide, compiled and edited by Edward Beckenstein, and published by Heating Publishers, Inc., 232 Madison Ave., New York 16, N. Y. Radiation requirements are given for each room with from one to three windows, many combinations of exposed sides, and ceiling heights from 7 to 12 ft inclusive. A section in the front of the book shows the

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Here is a book that presents—in simple, readily understandable form—every kind of information necessary for an accurate and thorough knowledge of air conditioning principles, equipment, and practices. Written by S. R. Lewis, a widely-known consulting engineer who has been active in air conditioning work for more than thirty years, it deals with all angles of the air conditioning subject from the practicing engineer's viewpoint. The designing procedures explained in the book are, for example, in every detail the same procedures employed today by the author's own organization.

Featuring this third edition are chapters on phases of the subject not previously treated, including noise control, air conditioning measurements, air conditioning standards, fire protection codes and operating suggestions. Several complete examples of correct design procedure are given, together with forms for recording the design data, the proper filling-in of which are explained step-by-step.

The chapter devoted to Psychrometry presents nineteen different formulas for psychrometric calculations. In illustrating the correct use of these formulas, Mr. Lewis applies both the psychrometric tables and chart in order to render both devices thoroughly understandable.

OF VALUE BOTH AS A REFERENCE AND TEXT

Engineers in air conditioning will find the "Air Conditioning for Comfort" invaluable as a reference book, while salesmen, students, and others may rely on it to give them a clear knowledge of fundamentals, and of air conditioning methods and equipment.

Send for a copy today. We know you will consider this volume one of the most readable and complete books on the air conditioning science you have yet seen. You will risk nothing in ordering a copy, for you will be privileged to return it for a refund if for any reason it should prove unsatisfactory. Use the coupon at the left to order your copy now.

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CONTENTS

CHAP. 1—Terms used in Air Conditioning
CHAP. 2—Heat and Air
CHAP. 3—Air Conditioning Standards
CHAP. 4—Air Conditioning and the Human Body
CHAP. 5—The Psychrometric Table and Chart
CHAP. 6—Humidity Controllers and Control
CHAP. 7—Heat Transmission Through Barriers
CHAP. 8—Ventilation, Solar and Appliance Heat
CHAP. 9—Heating Systems
CHAP. 10—Air Conditioning Systems
CHAP. 11—Air Conditioning Apparatus
CHAP. 12—Refrigeration and Refrigerants
CHAP. 13—Refrigeration Compressors and Condensers
CHAP. 14—Refrigeration Evaporators and Auxiliaries
CHAP. 15—Record Forms for Heating and Cooling
CHAP. 16—Air Distribution
CHAP. 17—Water in Air Conditioning
CHAP. 18—Noise and Its Control
CHAP. 19—Air Conditioning Instruments and Measurements
CHAP. 20—Codes and Operating Suggestions
10" x 16" Psychrometric Chart..Inside Back Cover

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square feet per section of cast iron radiators of various styles and heights.

As explained in the foreword, the book is intended as an aid to quick estimating of radiation requirements for the various trades and occupations concerned with heating. Rules for determining radiation for conditions other than those assumed are also given.

Additional allowance has been made for such factors as sun room glass exposures, exposed doors, unheated spaces, forced circulation hot water, northern and western exposures, rooms with fireplaces, insulated roofs, storm sash and weatherstripping, air changes, unusual ceiling heights, and design temperatures other than 0 to 70 F. At the foot of each page containing data on a single room is shown the additional steam and hot water radiation required if the room has top floor roof exposure.

The book is pocket size, has a flexible binding and stiff paper covers. The tables are reproduced by photo off-set on a heavy bond paper. The data section and radiation tables occupy 200 pages. Price per copy is $3.

Analyzes Studies Made on Pulsations and its Effects on Flow Meters

Although pulsating flow has received considerable thought for a number of years and though a great deal of time and money have been spent to determine means for reducing the errors in meter readings resulting from pulsations, much work remains to be done—including a study of the pulsation theory. This is the conclusion of E. J. Lindahl, assistant professor of mechanical engineering, Ohio State University, after analyzing much of the pertinent work which has been done on this subject.

In his paper, Pulsation and its Effect on Flowmeters which was presented at the ASME semi-annual meeting in June, Mr. Lindahl points out that in steady flow through a device the velocity, temperature, and pressure at any point remain constant. In the case of unsteady flow one or more of these conditions does not exist and pulsating flow can exist when either rapid velocity or pressure changes occur. This is very common in practically all industrial fields. It is also generally accepted that any inferential-head meter will measure correctly if the secondary device will measure accurately the differential pressure across the primary element. In the case of steady flow this is a comparatively simple operation, but where the differential is irregular, as the result of rapid variations in pressure or velocity, the meter is invariably inaccurate because most secondary devices are too sluggish to follow the actual differential changes. In addition, the differential pressure recorded is an approximate average of the maximum and minimum pressures. When the square root of this average is taken, the resulting average introduces an error.

The author presents a theoretical, mathematical analysis of pulsation error caused by three types of wave forms, i.e., rectangular, sine, and triangular. He then briefly covers the work of many investigators from 1905 to the present time. His remarks concerning the findings and results of studies made up to this time serve to highlight the importance of continuing a program designed to develop methods for determining the degree of error in flow meters produced by pulsations.

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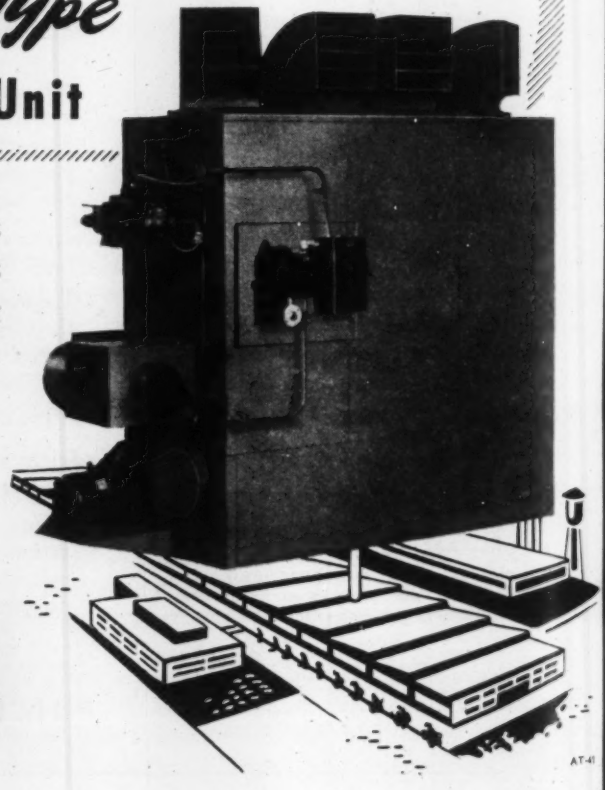

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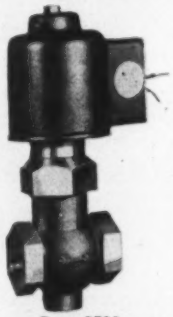
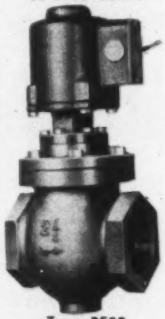
. . . designed for automatic control of air, water, gas, oil, brine, and refrigerants.


Type PFSB Screwed Bonnet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They're sure-acting, these ASCO Solenoid Shut-off Valves! The construction is such that when the valve is energized it is held open for full pipe area regardless of flow through the pipe line. When de-energized, the pilot closes the valve tightly, full-line pressure being applied to the top of the piston. Additional closing power is provided by a coil spring which closes the valve and keeps it closed when line pressure is low or absent.

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We also manufacture a quality line of Automatic Transfer Switches, Remote Control Switches, Contactors and Relays.

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MEETINGS & CONVENTIONS

"Trail Blazers" to Feature Chemical Exposition

New discoveries, new ideas, and new applications and developments in industrial chemistry will be the theme of an exhibit, The Chemical Trail Blazers, which will be a feature display at the 4th National Chemical Exposition to be held September 10 to 14 at the Coliseum in Chicago.

The semi-annual meeting of the American Chemical Society will be held concurrently, September 9 to 13, with sessions being conducted in various Chicago hotels.

Headquarters of the show, again sponsored by the Chicago section of the ACS, is in the Coliseum Administration Bldg., 1513 S Wabash Ave., Chicago 5, Ill.

1st National Instrumentation Conference and Exhibit Organized

Organization of the First National Instrumentation Conference and Exhibit, sponsored by The Instrument Society of America, is now practically completed. All sessions of the conference and exhibit will be held on the 17th floor of the Wm. Penn hotel, Pittsburgh, September 16-20, 1946. Fourteen sessions of the conference have been scheduled by The Instrument Society of America and three sessions have been arranged by the instruments and regulators division of the American Society of Mechanical Engineers.

Over 90 leading instrument manufacturers have already engaged space and it is expected the remaining space will be exhausted in the near future. Attendance at the conference and exhibit will be restricted to holders of special invitations which can be obtained from the secretary, Instrument Society of America, 1117 Wolfendale St., Pittsburgh 12, Pa.

One Day Meeting of Plumbing and Heating Industries Bureau Scheduled

The annual meeting of the Plumbing and Heating Industries Bureau, 35 E Wacker Dr., Chicago, will be held at the Palmer House, Chicago, September 18, according to an announcement by H. S. Blank, president. E. J. Gossett is chairman of the arrangement committee.

ASME Extends Fall Meeting

The 1946 fall meeting of the American Society of Mechanical Engineers, 29 W. 39th St., New York City, was originally planned as a three-day event. In order that more papers may be presented, the program has been extended one day and will be held at the Statler hotel, Boston, September 30 to October 3. Among the 18 technical sessions planned are several on heat transfer, hydraulics, management, power, and applied mechanics. Inspection trips will include visits to the Massachusetts Institute of Technology, the General Electric Co., and a number of other places of interest.

Associations to Meet During Week of All-Industry Refrigeration Show

Floor space already reserved for the 4th All-Industry

Refrigeration and Air Conditioning Exposition in the Cleveland Auditorium, October 29 to November 1, is more than double the total space used for the last industry show which was the largest pre-war event.

Plans are being made for the conventions of six associations in the industry to be held in Cleveland during the week of the show. While each association will have its own hotel headquarters, the exposition will be open to all branches of the industry for both attendance and exhibits.

In addition to the Refrigeration Equipment Manufacturers' Association, which is sponsoring the show with the cooperation of the frozen food locker group, other associations holding meetings and their headquarters are: Refrigeration Equipment Wholesalers Association, Hotel Statler; Refrigeration Service Engineers Society, Hotel Hollenden; National Frozen Food Locker Association, Allerton hotel; National Association of Refrigeration Contractors, Allerton Hotel. The REMA will have its headquarters at the Hotel Cleveland and the Frozen Food Locker Manufacturers and Suppliers Association will be at the Hotel Carter. While the show management has been assured that accommodations for all visitors and exhibitors will be available, it is recommended that Cleveland reservations be made as soon as possible.

Exhibits will cover all types of refrigeration, air conditioning, and frozen food equipment, as well as frozen food processing and wrapping materials, insulating materials, and many other related products. Exposition headquarters is at 1107 Clark Bldg., Pittsburgh 22, Pa., also headquarters of REMA.

Public Health Meeting Scheduled in November

The American Public Health Association, 1790 Broadway, New York 19, N. Y., is now formulating plans for its 74th annual meeting to be held in Cleveland, November 11 to 14. A preliminary program will be announced in the near future.

AWS to Meet During National Metal Congress and Exposition

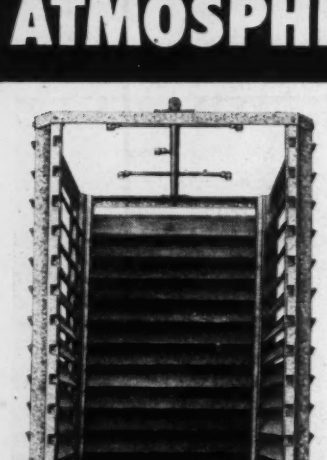
The 1946 annual meeting of the American Welding Society will be held during the National Metal Congress and Exposition in Atlantic City, November 17 to 22.

The exposition will be held in the Atlantic City Convention Hall, and the technical sessions, committee meetings, and social functions of the AWS will be held at the Ambassador hotel. The society urges all members who are planning to attend and who do not have confirmation of hotel reservation to fill out and send in the housing bureau circular sent to all members last March or to write to the Housing Bureau, 16 Central Pier, Atlantic City, N. J., indicating first, second, and third choice of hotels.

ASME Members to Meet in December for Annual Meeting

The 1946 annual meeting of the American Society of Mechanical Engineers, 29 W. 39th St., New York City, has been scheduled for December 2 to 6 and will be held in New York City. Plans for the 17th National Exposition of Power and Mechanical Engineering, bet-

30 STANDARD SIZES OF
ATMOSPHERIC SPRAY COOLING TOWERS



Binks Type "S" Atmospheric Spray Cooling Towers are built in 30 standard sizes with capacities from 10 to 1200 G.P.M. This wide range of sizes enables you to fit your requirements without the added expense of a custom-built installation.

Binks Type "S" Atmospheric Cooling Towers are ideal for use where natural air movement is available. They are recommended for the cooling of condenser circulating water for refrigeration and air conditioning compressors and for use with all sorts of water-jacketed machinery and manufacturing processes where water cooling is used.

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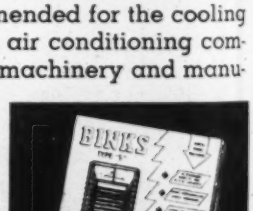
Bulletin No. 800 is a fact-packed booklet describing completely Binks Type "S" Atmospheric Spray Cooling Towers. It is filled with specification data, engineering drawings, tables, illustrations, dimensions and suggested rating for various types of service. To simplify your calculations, a typical performance table is included. *Drop a postcard in the mail today for your free copy of Bulletin No. 800.*



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OFFICES IN ALL IMPORTANT CITIES

known as the National Power Show, are practically completed. This year the show will return to the Grand Central Palace, New York City, and exhibits will consist primarily of equipment for the production of power from fuel, power transmission to machines, and some phases of power utilization.

Attendance at these expositions, which are normally held every two years, is restricted to qualified visitors, classified according to buying influence in the field of power production and use. Invitations this year will be based on revised lists, recognizing many dislocations resulting from the war and from the incidence of new industrial projects.

First established in 1922, the show is being conducted by the International Exposition Co. with permanent headquarters in Grand Central Palace, together with an advisory committee composed of leaders in power production and kindred fields.

Heating and Ventilating Exposition 90 Per Cent Booked

Manufacturers of heating, ventilating, and air conditioning equipment have engaged over 90 per cent of the total exhibit area of the 7th International Heating and Ventilating Exposition which will be held at Lakeside Hall, Cleveland, January 27 to 31, 1947.

The show is being sponsored by the American Society of Heating and Ventilating Engineers, whose 53rd annual meeting is to be held in Cleveland concurrently. Another of the several organizations to meet in the city during the same period is the National Warm Air Heating and Air Conditioning Association.

The exposition is under the general direction of the International Exposition Co. with permanent headquarters at Grand Central Palace, New York City. General planning and policies are being formulated by an advisory committee of professional and industrial leaders under the chairmanship of A. J. Offner, president of the ASHVE.

NACE Plans April Convention

The National Association of Corrosion Engineers will hold its next convention April 7 to 10, 1947, at the Palmer House, Chicago. Association headquarters is in the Southern Standards Bldg., Houston, Tex.

OHI to Meet in Spring of 1947

The board of directors of the National Oil Heat Institute, 30 Rockefeller Plaza, New York 20, N. Y., has voted unanimously to hold a convention and exposition in the spring of 1947. In all probability the convention will be held either in Chicago or Boston.

* * *

If you are planning to attend a meeting or convention, it is suggested that you write the headquarters office of the sponsoring society or group for a copy of the program, and information about hotel reservations, etc. The street addresses of the various societies are given above for this purpose. Sometimes the dates or complete plans for such meetings are changed, and it is well, before making your own arrangements, to check with those in charge of the affair to be sure that no such changes will affect your own schedule. The editors of Heating, Piping & Air Conditioning will be glad to forward your requests for more information to the various societies, if it is more convenient for you to write direct to us.

Flight-tested to 100 Degrees Below Zero with

FRICK

Refrigeration

Reports on the temperature, humidity, and pressure of the air are radioed back to recording instruments on the earth by the Bendix-Friez Radiosonde, carried to heights of 16 miles or more by a balloon. These "weather" reports proved invaluable to the United Nations during the War: thousands of Radiosondes were sent aloft each month.

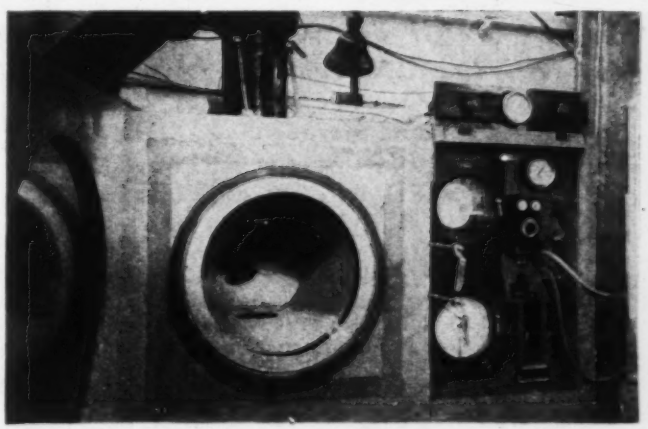
The Friez Instrument Division of Bendix Aviation Corp. calibrates Radiosondes in its plant at Towson, Md., with the test chamber shown below. This is cooled from +104 to —100 deg. F. in 75 minutes, the air pressure being simultaneously reduced to match flight conditions. Cooling is accurately controlled by a two-stage Frick refrigerating system using Freon-22.

The installation was designed and erected by the Paul J. Vincent Co., Frick Distributors at Baltimore.

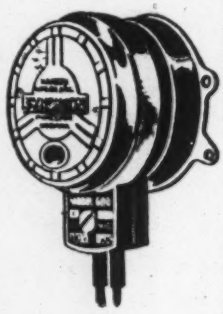
For the solution of that particular refrigerating, ice making, or air conditioning problem of yours, get in touch with the nearest Frick Branch or Distributor.

Export Division

FRICK COMPANY, WAYNESBORO, PENNA.



— orders are pouring in for

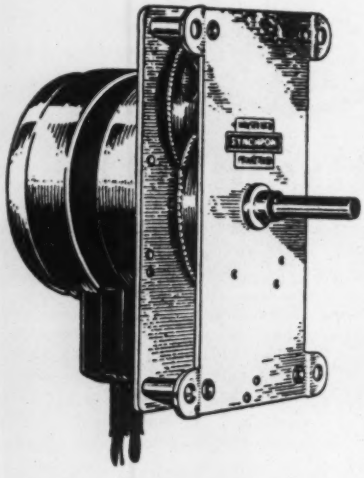


SYNCHRON

TIMING MOTORS

AND

TIME MACHINES



● "First come, first served" of course, but we are working hard to bring production up to meet the demand as soon as possible. Our engineers are now in position to work with you on special designs.

● SYNCHRON Motors are compactly built, with rotor and coil nested in a sturdy, streamlined case only 2¾" x 1 and 15/16". These motors have power to pull 8 oz. direct load continuously at 1 RPM, and they are pretested to operate at 30 degrees below zero or 140 above.

● SYNCHRON Timing Machines—powered by SYNCHRON Motors—are accurate, long-wearing, and easy to mount. They operate at standard intervals of 1 RPM, 1 RPH, 1 RP12H, and 1 RPD. Other intervals, if desired.

Write for SYNCHRON Catalog, complete with engineering data.

HANSEN MANUFACTURING CO., Inc.

Princeton 6, Indiana

RECENT TRADE LITERATURE

For your convenience in obtaining copies of these bulletins, see coupon on page 155. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending requests to Heating, Piping & Air Conditioning.

Air Conditioning System

No. 6239—The "Conduit Weathermaster" system of air conditioning, which is designed to eliminate ducts in multi-room buildings, is the topic of another in the 1946 series of catalogs issued by the Carrier Corp., 302 S. Geddes St., Syracuse 1, N. Y. The latest booklet is addressed primarily to owners and prospective builders of office and apartment buildings, hospitals and hotels. The operation of the system is described and illustrated and a number of well known installations are cited. Aside from saving space, the catalog emphasizes that properties are made more rentable through "elimination of noise transmission from other rooms and from outdoors, isolation from odors in nearby rooms, and comfort as to temperature because the occupant controls the dials."

Air Distribution in Railroad Cars

No. 6240—The Vol. 2, No. 5 issue of Aspiration, the house organ of the Anemostat Corp., 10 E. 39th St., New York 16, N. Y., features a discussion of railway air conditioning and air distribution. After citing some of the early developments in this type of conditioning and after pointing out that the nation's railroads are now faced with keen competition, which will result in greatly improved passenger comfort, a brief review of the more common air conditioning systems now in use is given. The problems of air distribution peculiar to railroad cars are discussed and the use of the company's products is featured.

Arc Welding Electrodes

No. 6241—Applications, characteristics, physical and chemical properties, and recommended welding procedures for over 40 "Murex" arc welding electrodes are illustrated and described in a 92 page catalog issued by the Metal & Thermit Corp., 120 Broadway, New York 5, N. Y. Broken down into use classifications, the new issue includes electrodes for a-c and d-c welding of mild steels, low alloy steels, bronzes, and cast iron, as well as for hard surfacing, automatic welding, and underwater cutting and welding work. Among the new electrodes listed are types for welding sulphur bearing and high carbon steels. A chrome-moly series of eight electrodes designed to provide tensile strengths from 77,500 to 130,500 psi is also covered.

Atomizing Deaerators

No. 6242—Technical details and application data on atomizing deaerators are contained in publication No. 4160 issued by the Cochrane Corp., 17th St. and Allegheny Ave., Philadelphia 32, Pa. In this type deaerator incoming water is first heated to practically saturated

steam temperature by being sprayed in direct contact with steam. After this initial heating, the water contacts a high velocity steam jet which finely divides or atomizes the water, simultaneously scrubbing away the noncondensable gases.

Attic Ventilation

No. 6243—The Propeller Fan Manufacturers' Association, 5-208 General Motors Bldg., Detroit 2, Mich., has issued a new bulletin, Attic Ventilation Code. Prepared by the engineering committee of the association, an attempt has been made to set forth the basic requirements of satisfactory attic ventilation in the hope that contractors, users, and others will find the publication helpful.

Catalog Index for Hose and Couplings

No. 6244—A new catalog index sheet has been prepared by the Seamlex Co., Inc., 41-23 24th St., Long Island City 1, N. Y., for the purpose of facilitating more complete use of the company's literature. Service conditions for various types of hose and couplings are listed with respect to ranges of pressures, temperatures, degrees of flexing, etc. The company's bulletins covering the recommended product for each of the specified service conditions are identified.

Centrifugal Pumps

No. 6245—The Carver Pump Co., Muscatine, Iowa, has recently issued an 8 page bulletin (No. 200) describing a new line of centrifugal pumps ranging in capacity from 40 to 900 gpm at heads up to 200 ft or higher. Included in the bulletin are details of the hydraulic design which the manufacturer says results in higher pumping efficiency for all classes of general service. Units are available with a choice of enclosures for hazardous locations.

Cold Diffusers

No. 6246—Cold diffusers, ranging from small ceiling-suspended types designed for retail shops to large floor-mounted models for quick freezing plants, are covered in the latest in a series of 36 booklets being published by the Carrier Corp., 302 S. Geddes St., Syracuse 1, N. Y. The 16 page booklet discusses various applications, such as product cooling, blast freezing, and storage at temperatures below the comfort range, for which the different models are intended.

Condensate Oil Removal Filters

No. 6247—The advantages, as stated by the manufacturer, of the preformed floc type of condensate oil removal filter over the granular bed type filters with separate alum and alkali feeds, are described in a bulletin issued by The Permutit Co., 330 W. 42nd St., New York 18, N. Y. The booklet includes details on the operation of the rake agitator and rotary surface washer units.

Continuous Blowoff for Boiler Plants

No. 6248—A two-part paper, Continuous Blowoff for Boiler Plants, has been reprinted by the Cochrane Corp.,

TALLMADGE ZONED CONTROLLED HEATING SYSTEMS

For better heating at less cost

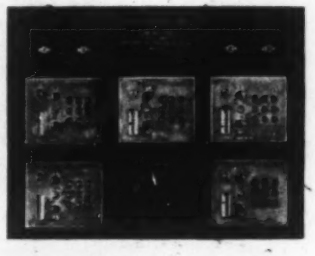


Figure 1

Figure 3

Figure 4

Figure 2

Figure 5

THE TALLMADGE equipment shown above is for a Zoned Heating System, either automatic or remote control (Figure 1). Airotherms, (Figure 2) for outside control, determine the heating requirements and set Pressure Boxes (Figure 3) to regulate the steam pressure to each zone. Zone valves (Figure 4) control the steam passing to the radiators. Orifices (Figure 5) meter the steam entering the radiators.

ADVANTAGES: Precise control of steam. Elimination of over-heating and costly waste of fuel. Low cost of maintenance. Saving on outlay for original equipment. Greater comfort to occupants due to steady heat and modulated even distribution.

WEBSTER TALLMADGE & CO., Inc. 364 Glenwood Ave., East Orange, N. J.

17th St. and Allegheny Ave., Philadelphia 32, Pa. The authors, H. C. Ebert and Joseph Thompson, discuss heat recovery from boiler blowoff waters, the concentration of solids in boiler water, the calculation of dollar savings estimates, and the value of flash steam recovery.

Direct Fired Air Heater

No. 6249—Weatherall Engineers, Inc., 3 Friendship St., Providence, R. I., has issued a booklet describing the "Weathertherm" direct fired heater which is designed for use with coal, gas, or oil. Sizes range from 75 thousand to 5 million Btu per hr output and the construction is all steel featuring diagonal heating tubes of seamless boiler tubing.

Electric Heaters

No. 6250—Electrical resistance heaters of the portable and built-in wall type are described and illustrated in a 20 page brochure, 46-D, released by the Electromode Corp., Rochester 2, N. Y. Also described are the company's patented heating elements used in these units which are available in sizes from 1500 to 3000 watts. Data on power consumption and wiring requirements are included.

Electrode Selection Chart

No. 6251—A graphic, 25 x 40 in. electrode selection chart has been published by Air Reduction Sales Co., 60 E. 42nd St., New York City. It has been prepared to assist operators in the choice of the correct electrode for a particular job. Electrical data, mechanical properties, and a color guide are given, and the electrodes covered are designed for mild, alloy, and stainless steels as well as for cast iron, and hard-facing operations. A special section is devoted to special purpose electrodes.

Electronic Combustion Control

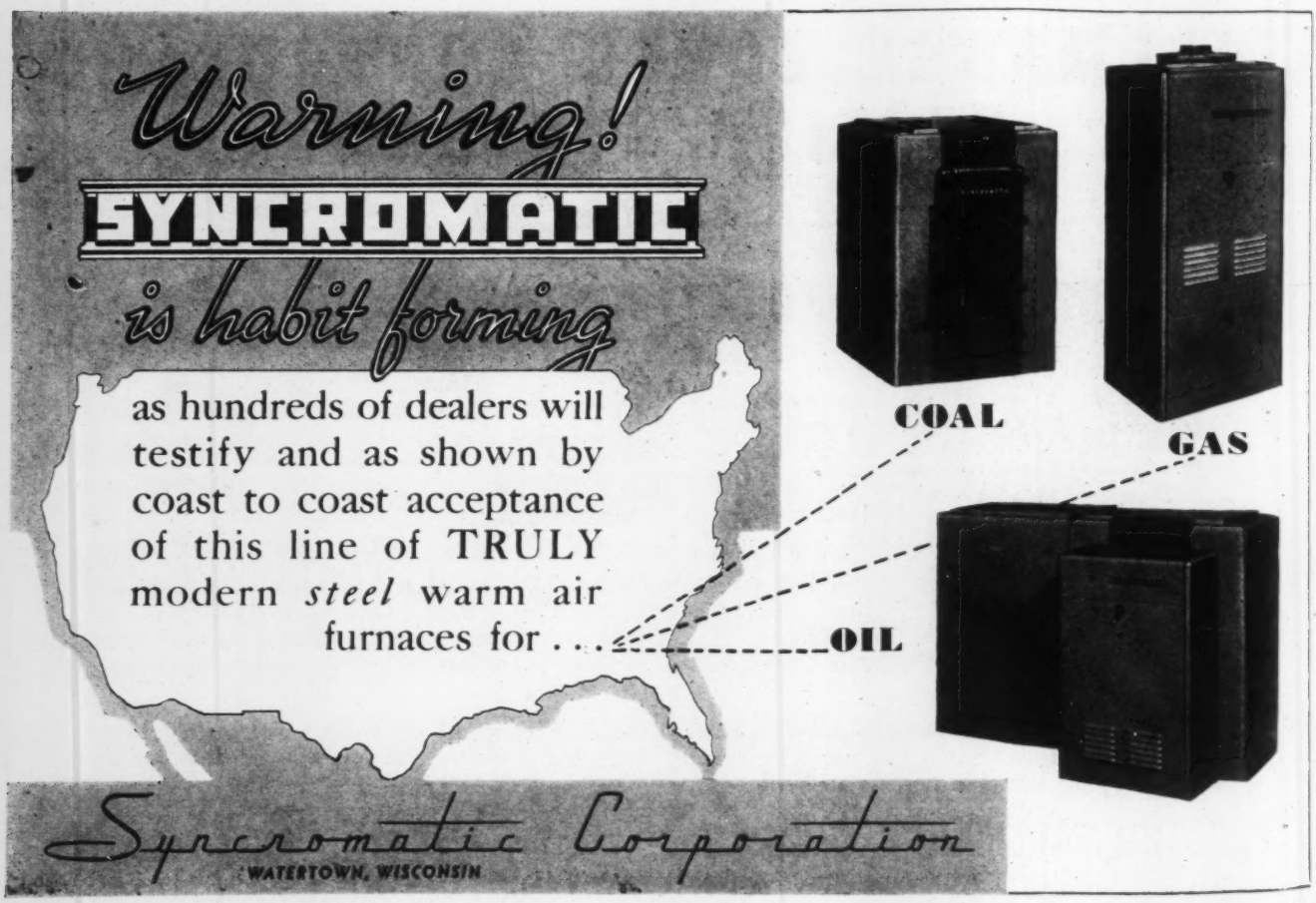
No. 6252—Possible reductions of 15 to 20 per cent in fuel consumption through improved combustion efficiency and boiler heat exchange are discussed in a new bulletin issued by the General Power Plant Corp., 381 4th Ave., New York 16, N. Y. The principle of haze control together with a description of the company's "Robot Eye" combustion control unit are included.

Equipment for Process Industries

No. 6253—A 16 page booklet, 25B6177B, issued by Allis-Chalmers Mfg. Co., Milwaukee 1, Wis., features a series of thumbnail "buying guides" aimed to help the reader in making preliminary selections of a wide range of the company's industrial products including motors, motor controls, power generation and distribution equipment, vibrating screens, feeders, washing equipment, pumps, blowers, compressors, V belt drives, together with electronic heating and welding equipment.

Flexible Couplings

No. 6254—Stressing simplicity of design and long life, a new bulletin, SL-1000-1, describes the resilient flexible couplings offered by the Crocker-Wheeler Div., Joshua Hendy Iron Works, Ampere, N. J. Couplings in


Warning!
SYNCROMATIC
is habit forming
as hundreds of dealers will testify and as shown by coast to coast acceptance of this line of TRULY modern steel warm air furnaces for . . .
COAL
GAS
OIL
Syncromatic Corporation
WATERTOWN, WISCONSIN

operation and features of construction are illustrated. Among the advantages which the manufacturer stresses are maximum torsional flexibility, great shock absorbing capacity, and trouble-free operation. Dimensions and capacities of the 12 available sizes range from ½ to 6 in. shaft diameter, 1 to 120 hp per 100 rpm, and 1200 to 7000 max rpm.

Flush Latches and Hinges

No. 6255—The Hartwell Engineering Co., 3417 Crenshaw Blvd., Los Angeles 16, Calif., developed a line of trigger action, flush latches which were first used on aircraft. Today, there are four different types of these latches offered for diversified use in all lines of industry. They are said to provide complete flushness, eliminate removal and replacement of screws, release when fingertip pressure is applied on the trigger, and to lock shut when fingertip pressure is applied on the bolt. An 18 page catalog, just issued by the manufacturer, illustrates the operation of the latches and provides technical descriptive data.

Heating and Air Conditioning Control Instruments

No. 6256—Pneumatic instruments for controlling and recording in heating, humidifying, ventilating, cooling, and dehumidifying systems, which are offered by Taylor Instrument Companies, 95 Ames St., Rochester 1, N. Y., are described in a new 45 page catalog (No. 5). Some 20 odd basic control systems are described and illustrated. Thermometers, barometers, anemometers, sling psychrometers, and a refrigeration test set are covered. A 9½ x 15 in. reproduction of the Carrier psychrometric chart is included.

Heating and Ventilating Equipment

No. 6257—A condensed catalog in pamphlet form has been issued by the L. J. Wing Co., 154 W. 14th St., New York 11, N. Y. Briefly described and illustrated are the company's unit heaters, industrial fog eliminators, heater sections, steam turbines, motor driven and turbine driven blowers, furnace draft inducers, duct fans propeller fans, self closing shutters, and ship ventilators. A brief history of the company is also given.

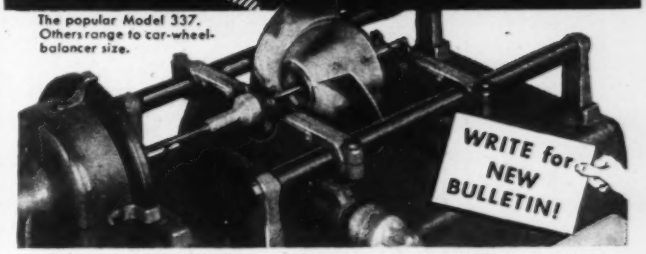
Heating Control System

No. 6258—A consumer booklet, Comfort Unlimited, describes the "Moduflow" automatic heating control system offered by Minneapolis-Honeywell Regulator Co., 2604 4th Ave., S., Minneapolis 8, Minn. The booklet follows an earlier publication on the subject, and in addition to describing the application of this control system to the more conventional heating systems such as steam, warm air, and hot water, also discusses its application to zone control, radiant panel heating, solar heating, electric heating, and air conditioning.

Horizontal Feed Stoker

No. 6259—Specification sheet No. 608 illustrates and describes model "H-C" stokers for boilers of 130 to 500 hp. Offered by Whiting Stoker Sales Co., 11 S. LaSalle St., Chicago 3, Ill., these units are designed so that coal is fed across the front end of the grate from a hopper. The fuel bed moves progressively toward the rear due to the reciprocating action of alternate grate sections.

20 Per HOUR to 3 MILS!
(Displacement Tolerance)



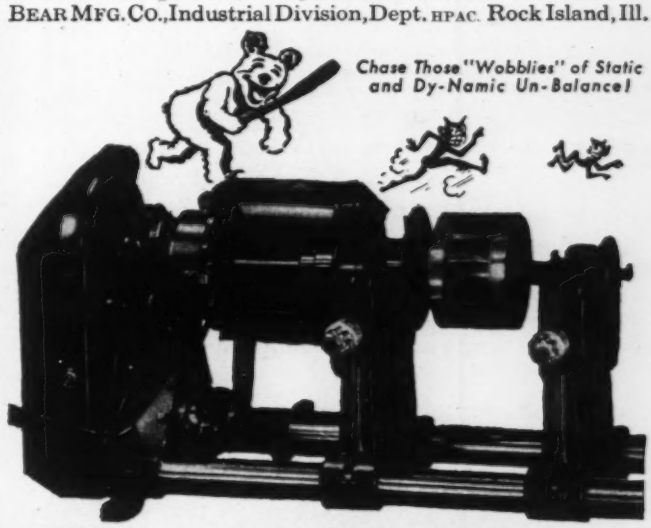
How One Manufacturer Profits by BEAR DY-NAMIC BALANCING

Reports the Dynamic Air Engineering Co. of Los Angeles: "Bear eliminates the "Wobblies" of un-balance in high speed axial flow propellers faster than 20 per hour to a 3 mil displacement tolerance." Here, as always, the Bear machine is so small in size, and so quick, that the operation fits readily into production.

BEAR-BALANCING: QUICK, EASY, SURE and LOW-PRICED

There is a Bear Static and Dy-Namic Balancer for all rotating parts, from two-ton bodies to tiny aluminum impellers. Each Bear machine is widely adaptable within its range; Model 340, above, is a very popular balancer throughout industry.

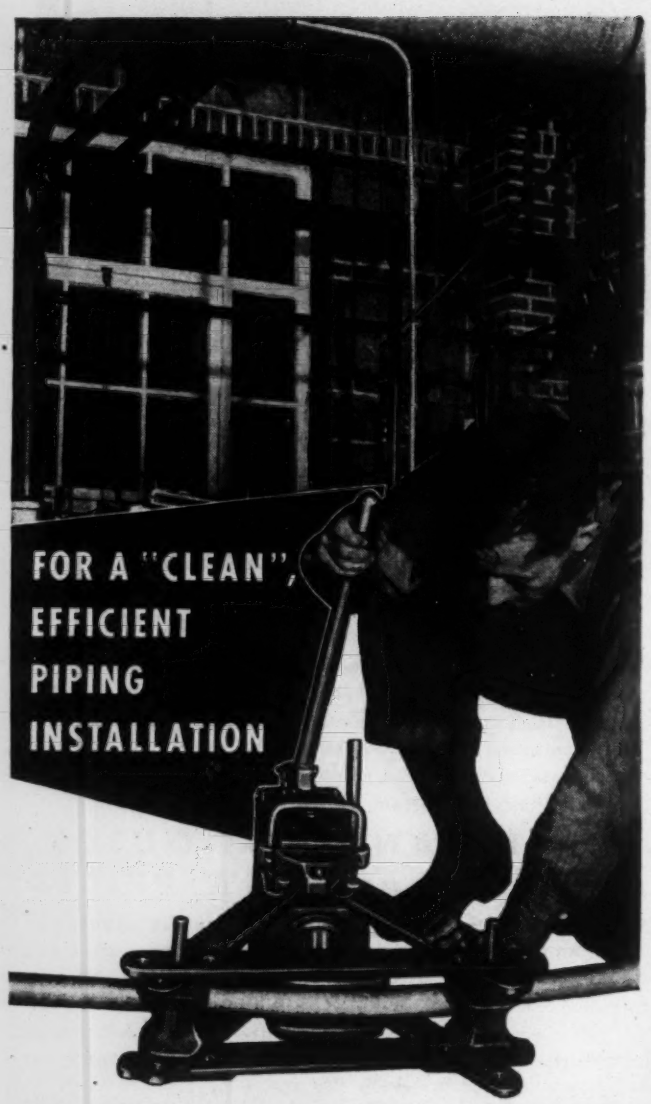
All Bear machines will balance bodies to any recognized standard, QUICKLY. This speed makes Bear-Balancing an inexpensive operation, which fits smoothly into production flow. Any shop hand learns Bear-Balancing in a half day. And best of all, Bear Balancers are very reasonably priced. So, for the good it will do you now and in the future, get the facts on Bear-Balancing! Write today for the new Bear literature!... BEAR MFG. CO., Industrial Division, Dept. HPAC. Rock Island, Ill.



Write for Bulletin!

BEAR COMBINATION

STATIC AND DY-NAMIC BALANCING MACHINES



GREENLEE HYDRAULIC BENDER

It's a more efficient piping job if it's bent . . . both from the standpoint of installation details and final working results.

Users of the one-man-operated GREENLEE Bender report not only great savings in labor and fittings plus a big reduction in spoilage, but, most important . . . smoother, better-appearing, *better-working* installations.

And that applies to radiant heating and all other types of jobs where steel and wrought iron pipe must go around, over and under obstructions.

In timesavings alone, the GREENLEE Bender often pays for itself on the first few jobs. Get complete information now on this equipment for bending pipe sizes from ½" to 4½". Write Greenlee Tool Co., 2348 Twelfth Street, Rockford, Illinois, for free "Case Study" folder S-121.

80th Anniversary
1866-1946

REGISTERED TOOLS
GREENLEE
FOR THE CRAFTSMAN

The strokes of the grate sections may be varied from 0 to 4½ in. in length and, according to the manufacturer, the fuel bed thickness may be adjusted between 4 and 7 in.

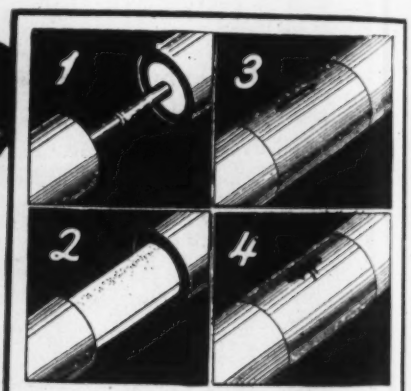
Industrial Electrical Equipment

No. 6260—Electrical products designed for a wide variety of industries are described and illustrated in a new 16 page handbook issued by Allis-Chalmers Mfg. Co., Milwaukee 1, Wis. Eight classifications of equipment ranging from a-c and d-c motors of ½ to 50,000 hp to electronic heaters are described. Data covering types, maximum horsepower, voltage, etc., on controllers is included, and also covered are V belt drives, transformers, switchboards, switch gear and circuit breakers, equipment for power generation, centrifugal pumps, and water conditioning chemicals and equipment. The booklet is identified as B-6542.

Liquid Level Control

No. 6261—Liquid level controls, wherein the liquid in contact with stainless steel probe rods makes and breaks an electrical circuit, are described and illustrated in an 8 page bulletin (No. 201-P) issued by Photoswitch Inc., 77 Broadway, Cambridge 42, Mass. Units are designed for controlling the level of water, milk, beer, ammonium chloride, copper nitrate, sodium chloride, potassium hydroxide, and many other acids, bases, and salts.

Positive Protection



BUILT-IN at FACTORY

For all your underground and exposed piping jobs you'll like DURANT Pre-Sealed Insulated Pipe. It is waterproof . . . reduces installation costs to a minimum . . . eliminates electrolysis and corrosion . . . requires very little trenching and field work . . . avoids extra cost of waste and breakage . . . comes to you ready to install. In short, D.I.P. is the *perfect pipe* for this type of job. Investigate D.I.P.! Write for details today.

4 Simple Steps

1. Field joint ready for inspection. 2. Joint covered with standard pipe insulation. 3. Durant joint casing in place ready for asphalt. 4. Asphalt poured in slot making a perfect seal.

Ready to Install

PRE SEALED

FOR STEAM HOT WATER REFRIGERATION

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INSULATED PIPE CO.
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D.I.P.

MADE MARK

The ORIGINAL Pre-sealed Insulated Pipe

LOCKE

REDUCING VALVE *and* PUMP GOVERNOR

Now Available

- ★ Rugged Construction
- ★ Extreme Range
- ★ Direct Acting
- ★ Uniform Reduced Pressure
- ★ Cast or Composition Bronze
- ★ Extreme Sensitivity
- ★ Compact Size
- ★ Operates Smoothly
- ★ Sizes up to 2″
- ★ True, Even Pressure

For use as pump governor it will be furnished with a stuffing box that usually lasts the life of the governor. Initial Pressures up to 250 lbs. Reduced to 10 lbs. with 20 lb. range.

A catalogue or consultant available at your request.

DIVISION OF THE H. T. WILSON MACHINE CO., INC.

LOCKE REGULATOR COMPANY

WALTER AND OSBORNE STREETS
SALEM MASSACHUSETTS

PEACOCK BROS., LTD. • MONTREAL, CANADA
Canadian Representatives

Hydraulic Regulators • Damper Regulators • Fan Engine Regulators
Back Pressure Valves • Balanced Valves • Electric Valves
Reducing Controls • Pump Governors • Vacuum Breakers
Engine Stops • Master Regulators • Oil Control Valves
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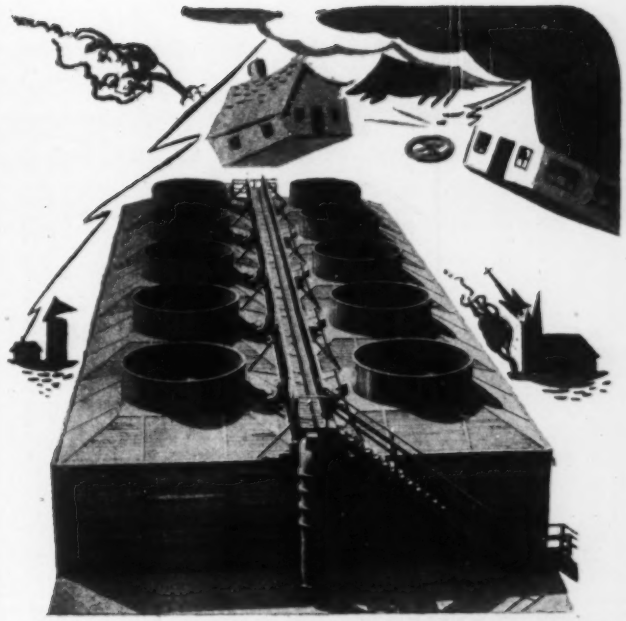
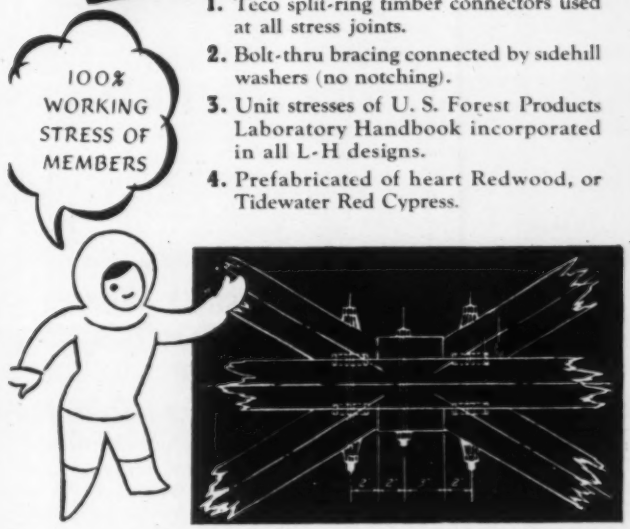


L-H Towers withstand wind pressures up to 150 m.p.h. without guy lines.

ANOTHER L-H *Feature* MAXIMUM STRUCTURAL STRENGTH



1. Teco split-ring timber connectors used at all stress joints.
2. Bolt-thru bracing connected by sidehill washers (no notching).
3. Unit stresses of U. S. Forest Products Laboratory Handbook incorporated in all L-H designs.
4. Prefabricated of heart Redwood, or Tidewater Red Cypress.

L-H FEATURES: • Low pumping and power cost... open-flume and gravity-type distribution. • Maintenance-free reduction gear and drive shaft. • Pre-tested performance based on L-H 48-year installations record.

Write for Catalog 440-A.

Lilie-Hoffmann
COOLING TOWERS, INC.

Manufacturers of All Types of Water Cooling Towers

GENERAL OFFICE: 4239 DUNCAN AVE., ST. LOUIS 10, MO.
PLANTS AT ST. LOUIS, MO., AND PLAINVIEW, TEXAS

DUO-THERM
Speed Nuts are faster to apply and don't require a wrench. They can generally be located adjacent to a flange so they cannot turn. This means they can be installed in places hard to get to with a wrench.
I asked the Service Department if they liked Speed Nuts and why, and was advised that Speed Nuts were a tremendous aid in replacing and servicing of parts. We have approximately 600,000 units in the field so that servicing is materially simplified by the use of the easily removed Speed Nut as compared to a rusted bolt and nut that may have to be chiseled or sawed off.
ASSEMBLY ADVANTAGES
Applied faster
Will not "freeze" to threads
Will not clog with paint
Reduce assembly costs
Eliminate lock washers
Eliminate handling of material
Perform multiple functions
Weigh less
Prevent vibration loosening
Protect fragile materials against damage

Let SPEED NUT USERS tell you why They Changed to SPEED NUTS

Let Duo-Therm's Chief Engineer, D. F. Jones, tell you what he thinks. His letter above leaves no doubt about the advantages of SPEED NUTS in the manufacture and servicing of hundreds of thousands of fuel oil heaters by the Duo-Therm Division of Motor Wheel Corporation.

Why postpone the improvement of your product assembly? Eliminate waste motions, unnecessary parts and useless weight by changing to SPEED NUTS. Send your complete assembly details when writing for samples as SPEED NUTS are made in over 3,000 shapes and sizes.

TINNERMAN PRODUCTS, INC. • 2018 Fulton Road, Cleveland 13, Ohio

Speed Nuts

FASTEST THING IN FASTENINGS

Low Pressure Evaporators

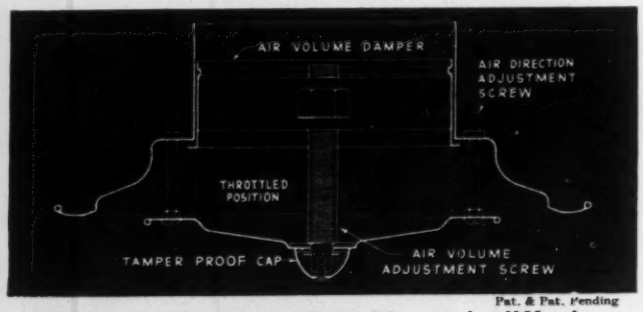
No. 6262—Features and economies of low pressure evaporation are described in a new 16 page booklet issued by the Condenser Service and Engineering Co., 95 River St., Hoboken, N. J. The company's line of low pressure evaporators and distillers for various industrial and marine applications are also described and illustrated.

Manufacturer Observes 40th Anniversary

No. 6263—Incorporated in 1906 as Moline Heat, with only rented quarters and three employees, the Herman Nelson Corp., 1824 Third Ave., Moline, Ill., this year is making special observance of its 40th anniversary. During its entire history the company has confined itself exclusively to the manufacture of heating and ventilating equipment and now employs more than 400 persons. Steady growth has resulted in the establishment of a nation wide organization handling the company's line of equipment which includes unit heaters, unit ventilators, propeller and centrifugal fans.

A booklet, entitled 28,965,768 Man Hours Ago, has recently been published reviewing the history of the company.

At a dinner party honoring all employees with ten or more years of service, diamond emblems for more than 30 years of service were presented to two employees. Twenty-five year service emblems were presented to six, 20 year emblems to ten, fifteen year emblems to 30, and ten year emblems to 13 employees.



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All the advantages of draftless air diffusion
. . . *plus* FAST SYSTEM BALANCING
AIR PATTERN CONTROL
because Kno-Draft Air Diffusers are adjustable

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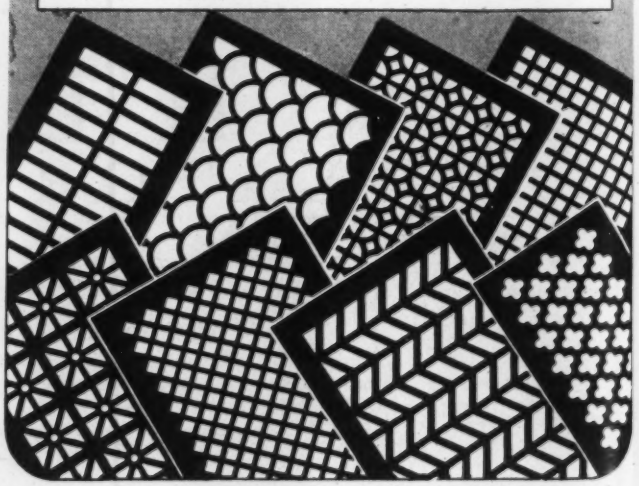

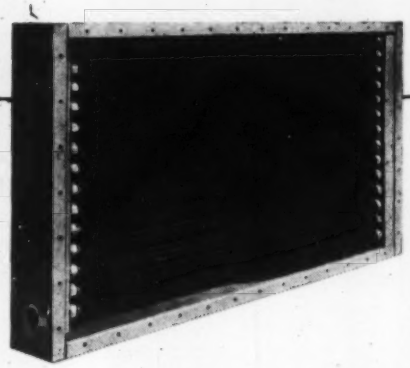

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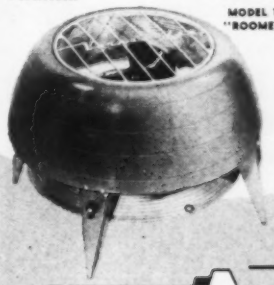

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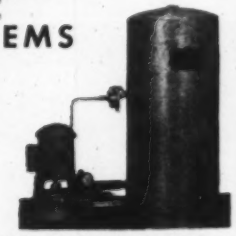

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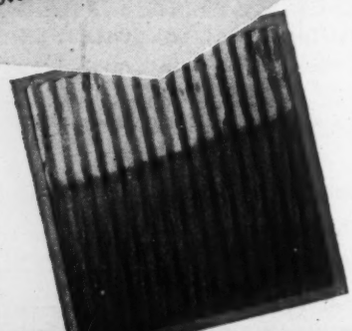

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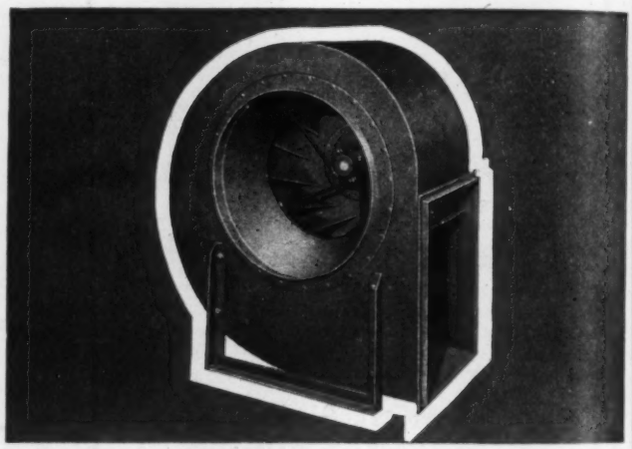
Oil Heating Equipment

No. 6266—A set of specification sheets, issued by the Williams Oil-O-Matic Div., Eureka Williams Corp., Bloomington, Ill., covers each product in the company's line of automatic oil heating equipment. A new folding



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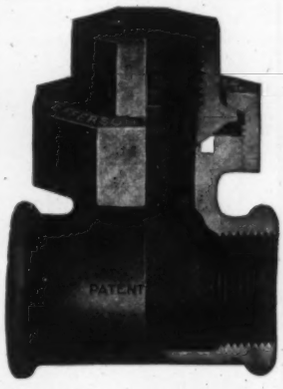

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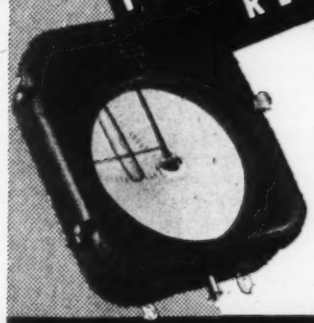

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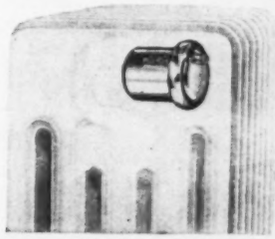

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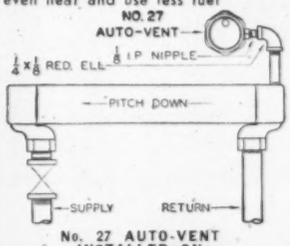

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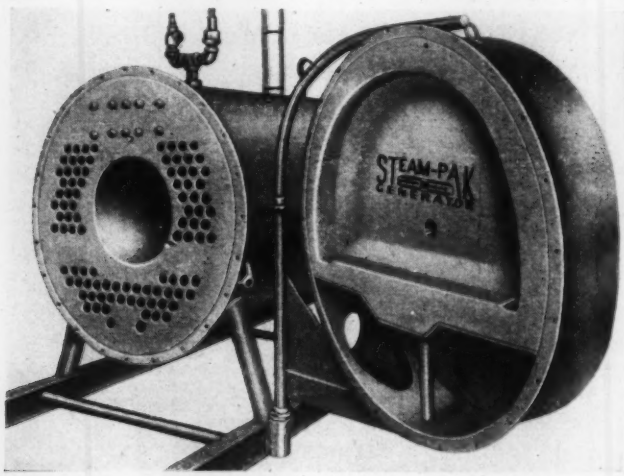

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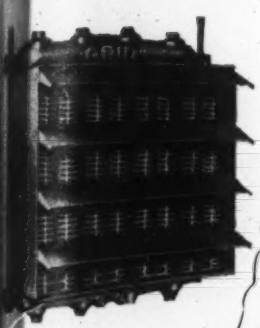

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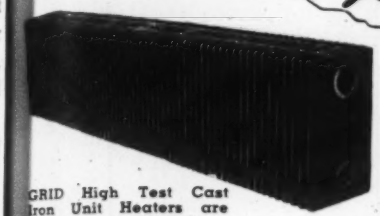

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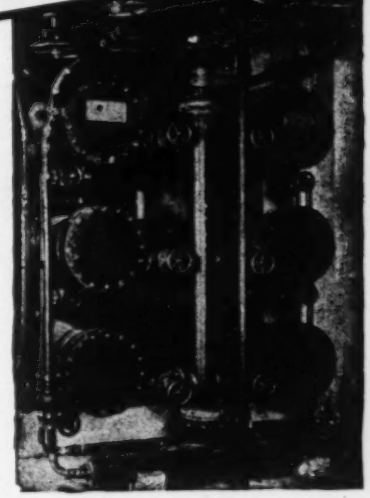

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